Midterm Report GLOCULL

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URBAN LIVING LABS

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Contents

Introduction to GLOCULL

Challenges in food, water and energy systems are locally and globally connected. For local actors, including cities, it is difficult to anticipate whether solutions to one issue in the FWE-nexus are sustainable across food, water and energy systems, both at the local and the global scale. The GLOCULL project therefore aims to develop an Urban Living Lab approach for innovations in the FWE nexus that are locally and globally sustainable. To support future implementation of this approach, guidelines and a participatory assessment tool kit will be developed through co-creation in seven Urban Living Labs (see figure below), based on an integrated assessment of local-global interactions in the FWE nexus and transdisciplinary action-research in the local Living Labs.

What are Living Labs?

Since 2011 we see rapidly increasingly numbers of peer reviewed publications with the concept "Living Lab(s)" in the title. Since 2016 we also see an increase in numbers of publications on living labs that specifically mention the word "Sustainable" in the abstract (see Annex 1). But what does a Living Lab entail, why is it useful for sustainability issues and how does it differ from concepts we already knew about and adopted before 2016? Although the angle taken towards, and the definition given to, Living Labs differs across publications we can describe Living Labs as "*participatory platforms for open innovation that support experimentation with real users in real contexts. Living labs can be understood*

both as a methodology and as a space for user participation in innovation processes" (Scholl et all., 2017, pp. 10).

Without going too much in detail, it can be said that many of the characterizing elements of living labs can also be recognized in other concepts and constellations such as participation, transdisciplinary research, sustainability science and joint knowledge production. However, the integration of these elements into one methodology or space for user participation (i.e. into a living lab) is rather unique.

Elements coming together in Living Labs, can be classified under the specific *goals* of the labs, the *approaches* adopted in these labs, and the way in which the labs are *organized and managed*. With regards to the **goals**, we see that knowledge integration and co-creation of knowledge and solutions can be portrayed as goals in themselves. These won't be the only goals, but the participants know and acknowledge knowledge integration to be an important goal of the living lab. Further, both innovation and learning are specified and directed rather than emerging as side effects.

On the adopted **approach**, we can say that living labs have an experimental character. In the most extreme form, both the process and the content (outcome) are open at the start of the project and are shaped in co-design with different lab participants. This means there are no pre-determined results and living labs are largely open for unexpected discoveries. Furthermore, living labs aim to enhance ties between institutions that use and create knowledge.

Goal and approach also have consequences for the way in which Living labs are **organized and managed**. We see that universities (i.e. researchers) have an important role in organizing and setting up the constellation of the lab. Next to researchers we see the involvement of public actors, private actors and the foreseen users of innovations that the lab intends to co-design. These actors together share ownership on the (co-created) process and meetings are usually self-organized (i.e. facilitation is mostly arranged internally). The living lab is furthermore strongly embedded in a specific geographical area (e.g. a city or a neighborhood). Participant selection is therefore mainly based on location/ geography rather than knowledge input or values.

In GLOCULL, we approach the living lab as the *constellation* that brings people together with the specific aims, approaches and management styles as explained above. In a living lab, one or more experiments can be defined, designed and tested. A crucial element comprises the question how and to what extent the experiment contributes to the foreseen/ desired innovation.

This report

In this report we describe the seven living labs of our GLOCULL project. We start with a general introduction of each living lab and the experiment(s) lying at the hearts of the labs. Afterwards we apply the evaluative scheme that we have developed in the GLOCULL project to each living lab. The evaluative scheme comprises of constructs (i.e. questions) that will be answered for the seven Living Labs. More information on the evaluative scheme and a manual on how to use the scheme, can be found at our GLOCULL website, or by contacting one of the contact persons referred to below. The information in this report provides the state of the art knowledge on the living labs according to the situation in November 2019. When Living Labs evolve through time, the answers to the constructs/ questions in the evaluative scheme may change as well.

Brazilian Living Lab - São Paulo

Introduction

São Paulo has initiated a series of actions motivated by its Local Agenda 21 and, more recently, by its Master Plan. These initiatives include improvements of urban green infrastructure (urban parks and gardens, vertical gardens, urban food production) that provide and protect ecosystem services and help the city to deal with increased temperature, extreme climate events, food security and water scarcity, by reducing soil sealing, mitigating heat island effect, enhancing water storage capacity in urban watersheds, and enabling local food production. Of particular interest is the integrated approach of the local government to the Billings Reservoir watershed, which is important for water supply to the São Paulo region, energy production by Henry Border Hydropower and tourism. The approach includes: increasing local sustainable agricultural production to protect the landscape, promotion of local social and economic development, and maintenance of a system of green areas to protect the Atlantic Rainforests and avoid urban sprawl. It is expected that these initiatives deliver multiple economic, social and environmental co-benefits. In this sense, the 'Connect the Dots Project' (Projeto Ligue os Pontos), of the City of São Paulo in partnership with the Bloomberg Foundation, seeks to carry out these actions in the south zone of the city through three main fronts:

1. Knowledge, making a census of the farmers who produce food in that region
2. Technical assistance to farmers to promote the transition to organic agriculture and improve traditional techniques; and
3. Production chain, assisting and seeking alternatives for better logistics between food production and distribution.

The Urban Living Lab of São Paulo works with the perspective of contributing to these actions from a water-energy-food nexus perspective, bringing together several actors from science and the public sector (e.g. representatives of the urban development secretariat), the green secretariat of the house of ecological agriculture of Parelheiros (district in the south zone of São Paulo), and representatives of the environmental protection areas in the south zone and the 'Connect the Dots' Project, among others. The activities are being carried out through participation in meetings of the main municipal and local councils, with interactive workshops, scientific/technical meetings and field work in the study area. Furthermore, another objective of the Urban Living Lab is the development of sustainability indicators through a participatory approach in order to validate the sustainability (through the lens of the water-energy-food nexus) of municipal actions in the rural area, with a particular focus on the activities that support local agriculture.

Setting

Environmental

The area can be characterized by a high concentration of water sources and remnants of Atlantic Forest, flora and fauna. The question is whether this is compatible with agriculture activities. There are 2 environmental protection areas, and water reservoirs for water supply and energy generation. There is no data about soil quality at the moment, however it is expected to have information on the subject throughout the project. As regard to climate, there is evidence of increasing dry periods in the São Paulo area. Water quality and soil contamination are issues that is always of great importance in the area.

Social/Cultural

Socio-economic data show great diversity between different areas in São Paulo. Statistical indicators are available, including information on:

- Socioeconomic (household income per capita; average income of woman responsible for the household; % of households with per capita household income up to 1/2 MW; % of households with per capita household income up to 1/4 MW; % of literate people responsible for the household).
- Demographic (% of people responsible for the household that are from 10 to 29 years old; % of women responsible for the household that are from 10 to 29 years old; average age of the people responsible for the household; % of children 0-5 years old.

Data show an aging population, particularly among the farmers of the region. Changes in value along the agroecology transitions. Federal government is not promoting environmental protection. How does this affect the situation at the local level? How does it generate conflicts, if it does?

Financial/Economic

There is a national economic crisis, leading to cuts to pro small-scale agriculture funds, shortages in municipal budgets, cuts in academic research activities. Agriculture, tourism and services are the main economic activities in the considered context.

Technical/Infrastructure

Water and energy distribution are managed by private or private-public companies. In general, there is insufficient access to water supply networks and insufficient sewage collection and treatment infrastructure. There are inconsistent electric energy supplies and road conditions make private transportation difficult; public transportation is not adequate. There is also a historical problem with irregular occupation of land partially due to insufficient housing stock and speculation of the housing market. The area is considered of great relevance to maintain and improve the green infrastructure of the municipality.

Legal/Political

A number of local, state and federal policies on water, agriculture, urban planning, and energy apply to the area. There is a strong sectoralization of public institutions in which the São Paulo Strategic Master Plan is a local effort to integrate sectoral public policies. A national political crisis drives policies against the environment (which seems to be the dominant ideology now). Besides, it is difficult to take actions at the local level, since the regulations on energy and water are largely decided at higher governmental levels. There are opportunities for public participation in the decision-making process (e.g. councils of the environmental protections areas), however this does not always result into actual participation of the population (for different reasons). There are also several NGOs acting on the territory on different issues (environment protection, sustainable tourism, agriculture, cultural activities, education, gender inclusion, etc…).

Organizational/Capacity

There are many organization involved in the region: “Subprefectures”, farmers’ cooperatives, technical support to farmers programme, Casa da Agricultura Ecologica (House of Ecologic Agriculture - CAE), Tourism Support programme, Support for Young Entrepreneurs, Support for developing local food value chain and marketing activities.

General Profile

Location and Scope

The Living lab is located in the city of São Paulo, with a specific focus (due to the activities currently occurring and the physical characteristics of the area) to the rural area in the South Region of the city. The urban living lab does not have an established physical location, however meetings often take place in the city-hall offices.

Purpose

Identifying problems and designing solutions with the objective of supporting public action in the area of sustainability (including a WEF nexus perspective as innovative element), and the development of sustainable indicators to inform public policies. However, the definition of new objectives is an ongoing process that will take place along the entire project.

Activities

At the moment we are participating and organizing meetings to discuss and plan future activities. There are Exploratory field works going on and we organized workshops.

Timeframe

Until the end of the GLOCULL project. However, there is the intention to extend the timeframe according to the development of other activities in the future.

Organizational Structure

Each (stakeholder) group has a main representative in the ULL; academic actors are those that mainly organize ULL activities; academic actors and municipality actors are those that mainly interact. Who has responsibility for outputs and risk-taking is still under discussion. A cooperation agreement has been signed by the university and the municipality to facilitate and formalize the activities.

Participants

- Public Health Faculty - USP
- Engineering school of São Carlos - USP
- Ligue os Pontos project team (Connect the dots - LOP)
- Casa da Agricultura Ecologica (House of Ecological Agriculture - CAE)
- Urban Development Secretariat - Municipality
- Green and Environment Secretariat - Municipality
- Environmental Protected Area Bororé-Colonia
- Environmental Protected Area Capivari-Monos
- Other participants may join the ULL according to next acrtivities

Background and History

The ULL emerged because of the project GLOCULL and because of already existing relationship between specific actors from the university and the municipality. Preliminary meetings were organized to design the outline of the project since a very first stage. Actors that took part to the first steps of the ULL setting are not necessarily still involved in the project.

Inputs

Awareness

There is general consensus and awareness between the participants to the ULL that a change is needed towards more sustainable practices. This is particularly true concerning best practices of sustainable agriculture, a transition to agroecology, water source protection, avoiding illegal urban occupation. The FWE concept was not known by the other participants of the ULL and it was brought in by the academic partners.

Commitment

Motivation might be different per partner. Production of knowledge is the main motivation for the participants of ULL. For example, the municipality is mainly interested in the development of knowledge and information to support the definition of public policies and decision-making. Information and knowledge are intended as a fundamental factor to support change and transformation. At the moment, academic and municipality actors seem to show the higher level of commitment, compared to others, in taking part to the ULL. This hopefully might change and improve in the future with a greater commitment from the other partners. In fact, improvements in this sense are expected with the implementation of the experiment(s).

Capacities (Expertise)

The participants of the ULL have a great variety of skills, all important for the purpose of the lab in different ways. We can count on the skills of experts in: geology, architecture, urban planning, agronomy, engineering, geography, public policies, business and marketing, geographic information systems. There are also people with great "local knowledge" because they have worked or lived in São Paulo and in the experiment area for a long time.

Trust

There is a good level of trust and transparency between the actors taking part in the ULL. Nevertheless, some constraints come from higher political levels that require the formalization of actors' relationship in order to "guarantee" trust and transparency. The cooperation agreement was required for this reason. Trust between partners is built on the possible gains for each participant. Exchange of benefits and so on.

Support

There is no specific funding for the ULL beyond the GLOCULL (via Fapesp) fund that is exclusively for the university partners. The municipality offers some kind of support in terms of space, information accessibility, facilitation of contact with other actors. CAE and LOP contribute with transportation and networking, but participation is mainly based on voluntary work.

Process

Experimental procedure

It is not yet possible to answer as regards the experiment, as this still needs to be shaped. This means procedures are rather open (at least at this moment).

Transformational Rationale / Methodology

The idea is that the co-creation process of knowledge is in itself a better way to support transformational changes, rather than rely on top-down solutions. The participation of different kind of actors in the identification of problems, design of solution and production of knowledge better guide the development of those changes that are really needed. This also legitimizes the ULL and experiments activities.

Transdisciplinarity

Transdisciplinarity was considered since the first draft of the project. Municipality and university partners were involved in the first developments of the projects: planning of the activities, recruiting of Post-doc researchers, designing of main objectives and activities. Other interests from higher-levels representatives of the public sector affect the relationship and the definition of objectives/activities. During the first phases of the project there was a specific actor from the public sector more involved than others and that more contributed to the design of the project

Reflexivity and learning

Meetings and workshops that occur in the ULL and experiment are spaces for constant reflexivity and learning. In these occasions, it is possible to discuss if adjustments are needed based on what is working and what is not. There is also little space for failure. The participants are not keen to take risks and the initiatives tend to aim at objectives that do not result in great losses if not achieved.

Openness and transparency

There are constraints from the municipality partners in making available existing data and information. This resulted in the necessity of formalizing the cooperation between university and municipality (through the cooperation agreement), the limitation of working with certain data only at the municipality offices and to reshape, to a certain degree, some of the activities and the experiment's focus. Information, results and data produced in the ULL or experiment activities are meant to be available to all and of easy access. However, this is still matter of discussion between the partners.

Outputs

Capacities

Efforts in building a ULL, creating a common knowledge of how a ULL is understood between different actors, dealing with and understanding the mechanisms of the public administration, facing the needs of different actors have contributed so far to increase our (from the side of the university) skills.

Knowledge

The participatory approach for developing sustainable indicators is expected to increase actors' awareness and knowledge on sustainability problems and solutions.

Accountability and Commitment

There is the expectation that our activities with a participatory perspective (both at the ULL and experiment level) will improve levels of commitment and accountability towards sustainable and positive changes. However, this is not detectable at the current stage.

Physical structures

Not applicable (yet)

Social structures

Not applicable at the moment

Uptake (transfer and scaling)

Not applicable at the moment

Outcomes

Answers greatly depend on the results of the experiment and on the process to develop the experiment. Furthermore, due to the specific feature of our experiment we expect to be able to answer comprehensively only the last two topics. We consider our work as the basis for the development of future solutions that will answer to the other topics and criteria.

Socio-ecological integrity

Not applicable at the moment, as the results of the experiment are still largely unknown.

Livelihood sufficiency and opportunity

Not applicable at the moment, as the results of the experiment are still largely unknown.

Intra- and intergenerational equity

Not applicable at the moment, as the results of the experiment are still largely unknown.

Resource maintenance and efficiency

Not applicable at the moment, as the results of the experiment are still largely unknown.

Socio-ecological stewardship and democratic governance

Having applied a participatory approach both at the ULL and the experiment level might ensure the involvement of a large variety of stakeholders (including those dealing with water, energy and food sectors). Sustainable decision-making is certainly an objective; however, we do not know if it will be achieved at the end of the project nor if it will be possible to measure it.

Precaution and adaptation

Both the final indicators themselves and the participatory process to develop them at the ULL level have the potential to lead to acknowledging uncertainty, avoiding uncomprehended risks, creating learning opportunities and preparing for surprises and change, however we do not know if it will be achieved at the end of the project nor how to measure it.

More information

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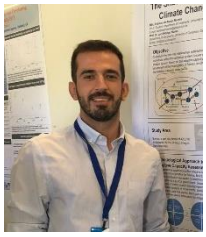

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Austrian Living Lab – Vienna

Introduction

Urban and peri-urban agricultural areas serve multiple purposes: they contribute to the urban food supply by providing fresh vegetables; they can be visited by local residents for recreation; they provide opportunities for educational activities for city dwellers to learn about food production; they are increasingly used by non-farmers to produce their own food (urban gardening, cooperatives); and they can be used for energy production with agro-photovoltaics.

Agro-photovoltaics (Agro-PV) represents a rather new way of renewable energy production, combining agricultural activities with energy production. Depending on the design and density of the panels, and hence the shading of the ground, Agro-PV can either reduce or increase agricultural productivity. Urban Agro-PV adds to the multi-functionality of urban and peri-urban agriculture at the food-water-energy nexus.

There a significant need for research and innovative solutions to link agricultural activities with renewable energy production. So far, in Central Europe only a few pilot projects on Agro-PV exist, mostly in rural areas. As with many other renewable energy technology, there is a general consensus

and acceptance at societal level - however, at the local level frequently conflicts arise. These challenges call for the development of new forms of governance. A particular governance challenge is the multitude of competing claims and trade-offs between the various functions of urban agricultural areas.

Description of the ULL: Up to now, hardly any Agro-PV has been implemented around Vienna. As part of the GLOCULL Urban Living Lab experiment in Austria, a small-scale temporary Agro-PV facility has been constructed in the Vienna suburb of Simmering. The aim of this experiment is to provide a real world experience for the stakeholders as well as to generate data on energy yields and effects of the PV panels on food production. Simmering is known for its numerous agricultural glasshouse areas, including those of LGV, an association of fresh vegetable producers. LGV is the local project partner of the Austrian ULL. Together with the two gardeners, who agreed to be part of the Agro-PV experiment, we are discussing the challenges of glasshouse production of tomatoes and cucumbers and thinking of potential solutions to render production of vegetables more sustainable. Agro-PV is one potential solutions, which we are testing on site. LGV specializes in glasshouse production, so the PV panels have been attached to the roofs of two greenhouses, in which tomatoes cucumbers are growing. The gardeners' energy consumption is being considered and compared with the potential of producing electricity using the PV panels installed on the greenhouse roofs. Moreover, plant growth, shading and technical requirements are considered and measured. The measured parameters should give a holistic overview of the possible electrical energy production and consumption. In addition, the daily vegetable harvest is weighed, which indicates a reduced or increased crop yield. One of the broader aims of the ULL is to use the experiment as an entry – point to discussing potentials of integrating Agto-PV into the vision, policy and implementation of energy efficiency measures in Austria. Moreover, due to the fact that costs of heating the greenhouses are more significant than those of electricity for the gardeners, the ULL partners are planning to engage in dialogue about potential options for renewable sources of heat, as well as improving energy efficiency of the vegetable production of the LGV gardeners.

Setting

Environmental

It is not possible to provide a well-founded and detailed answer to this question at the current stage, due to the fact that it requires thorough literature research. It will be provided at a later stage. The Gardeners did mention that the availability of sunshine is more important that outside temperature to the temperature inside the greenhouse, and also that the climate conditions (wind) influences to which extent they need power for ventilation and watering the plants in the greenhouses.

Social/Cultural

Making renewable energy visible could have educational effects, so people will see where energy is coming from. We need to place the energy with the landscape, and fill gaps in cooperation with other uses, such as agriculture. Robert mentioned that "knowing that one receives energy from solar or from the sun, makes one think about the ways of how or when one uses energy": if possible, you will use it during the mid-day, but if you have a direct interaction with your house as a gardener you rethink the schemes of when to use energy, if possible. The fact is that our main stakeholders are gardeners, they

know that their way of managing land is not always sustainable: Robert knows that it is strange that he needs to use gas for heating the greenhouse; but in the current situation he has no other opportunities (re Fernwarme); and we already know that PV panels cannot solve this issue, they cannot provide enough energy; but this is also why we need to bring this into a larger context of energy flows and coupling.

Financial/economic

It is a financial decision for the gardeners to explore the PV and also the heating source. It could be partly coincided with the social impacts: it is better to consume the energy according to Austrian society than bring it into the grid, because it costs more to get energy than to sell it.... so we can also think about whether or not the prices can eventually make it more attractive to be an "energy gardener/farmer", because bringing energy into the grid does not bring much money.

Under the current PV subsidy (i.e. feed-in tariff) and electricity market circumstances (i.e. electricity prices), the economic potential of the ULL would generally depend on climatic conditions and their change over time, PV panel material and their electricity conversion efficiencies, purchasing, installation and maintenance costs as well as opportunity costs, that arise from crop yield decreases due to area occupation or shading by PV panels. The economic effects of this ULL generally strongly depend on the rate of electricity self-consumption generated from the PV modules due to a fairly large spread between feed-in tariffs for PV and consumer electricity prices. Low consumer electricity prices, which may be the case for certain gardeners could otherwise provide an incentive to feed in the total generated PV electricity. Additional factors to consider when assessing the economic impacts, is a potentially reduced life expectancy of the PV installation due to increased panel degradation, when operated in an agricultural environment on the one hand and a potential decrease in crop yield due to shadowing or area occupied by PV panels on the other hand. Most of these factors are highly site-specific, such that purely monetary economic outcomes of this ULL may not be easily transferred to other sites.

Technical/Infrastructure

We are dealing with placing PV panels on a greenhouse - we saw while planning a demonstration object that it is difficult to place solar panels on top of greenhouses, and it is difficult to place additional infrastructure, which was usually done on normal rooftops, so in our case it is not as stable compared to a single family house. Also, the density of the PV panels has to coincide with the plants: some plants need a high amount of sunlight throughout the year, and some need more shadow (i.e. mushrooms, etc.), so there is a balance between how much energy and how much sunlight is needed.

Legal/Political

The city of Vienna has a strategy that open spaces and green spaces are highly important for recreation, so they do not want to go into these places with producing renewable energy… this is only a political issue, because they do not have issues with placing building infrastructure in formerly green spaces. You see that they say that renewable energy is important, but when it is visible in the landscape it is a different case, because it affects people's everyday experience.... Wind-power plants are more controversial, but in case of large-scale PV infrastructure it might become controversial as well... there may also be a legal or admin issue with potentially placing PV on open fields, which has

to do with the special planning - there different types of land and land uses are defined and separated. If it is agricultural land, you cannot produce energy there, depending on the federal district of Austria.... You can for this reason not apply for agroPV funding, because there is no agroPV - in this case a gardeners can get funds to place PV on houses, but not on the field.

Organizational/Capacity

LGV as an association and the GLOCULL demonstration project makes the other colleagues form this association curious about the looks and works of agroPV - they are interested in general; and the experience of our gardeners might influence the interest of other gardeners. We could also think about setting it on a higher level - we talked to the PV Austria representative, and they also want to feature agroPV, they are a lobbying organization for PV and they can promote the results to different groups. Before this was never a topic to place PV on greenhouses - only on farmhouses, so it is not in mind across the gardeners' community that they could produce large-scale energy on the fields/greenhouses... there exist very small solutions, such as single PV panels, loading the battery to use for the electric fence or for water pumps for drinking basins for livestock.

General Profile

Location and Scope

The living Lab is located in Simmering (11th district, south-east of Vienna), which is an industrial-working district, where the gardeners' association is based, and where agricultural production is located, with a focus on greenhouse production. The geographic scope is focused on these greenhouses, however, with a wider indirect scope of the city of Vienna, due to the question of whether or not agroPV could be expanded in Vienna - although at the time being, the city of Vienna does not see this as a priority.

We expect that based on the results of the experiment (if the photovoltaics are indeed profitable for the gardeners), that there will be a change on the level of the gardeners association (that more gardeners will be willing to install photovoltaics on the roofs of their greenhouses, and they will do it at a larger scale) - or potentially with a wider scope, with respect to the greenhouse production in Vienna.

Purpose

The purpose of the lab is to provide energy efficiency possibilities via agroPV for the sector of greenhouse food production, which is highly energy-intensive - specifically with a focus on an urban production site. The following domains are involved in the experiment: transdisciplinary research, agricultural engineering, sustainable economic development, landscape planning and development, agronomy, agricultural policy

The exact goal is to investigate potential energy efficiency of agroPV, by installing PV panels on the rooftops of greenhouses. This would provide an additional source of electricity for the gardeners, which would make them more independent from energy providers. Moreover, this will contribute to further developing sustainable greenhouse production (because it is a more energy efficient system, and it couples food and energy production), reaching climate goals for Austria; developing APV and widening options for PV in the city. Water is not as strong of a focus in our ULL, although we do

consider measuring the use of and the role of water in the system, and potential changes thereof as a result of our experiment.

Activities

Our experiment is independent, even though we are trying to integrate it into the existing energy, landscape planning and agricultural policy dialogues, and we are building on the previous experiences we had in this field. The main activities include experimenting and outreach, as well as facilitation of public discourse.

Timeframe

The current time horizon is 3 years, the duration of the GLOCULL project (2018-2021)

Organizational Structure

The Austrian project coordinator is BOKU, and as such it is the institution responsible for the outputs and experimentation. However, NIKKO PV is the industry partner of the ULL, and via this they have a formal role and responsibility for the technical installations of the PV panels as well.

BOKU ILEN (Institue for Landscape Development, Recreation and Conservation Planning) is the formal and de-facto leader and coordinator of the project. The coordination team is highly enthusiastic about and committed to the participatory nature of the project, and not only the technical, but also the wider social outcomes.

Participants

The main actors include:

- The scientific team - BOKU (Institue for Landscape Development, Recreation and Conservation, Institute for Agricultural Engineering, Institute for Sustainable Economic Development)
- NIKKO Photovoltaik (industry partner)
- LGV Frischgemüse Wien (local greenhouse gardeners- local expert)
- Smart City Vienna
- City of Vienna (MA20 Energieraumplanung).

Background and History

The city of Vienna defined its energy goals for 2030, where PV plays a large role. At the same time building-bound PV is hard to implement, because of the legal situation, and the climate (or solar) goals are not reachable without using the open space for energy production. Therefore, the idea of double land-use (coupled energy and food production) - creating multiple benefits and to use limited space within a dense, urban structure - lead to the idea of implementing AgroPV.

Inputs

Awareness

The gardeners, who are participating in the ULL are aware of the need for real-world changes - not only because they are struggling with the energy costs, but also because they have an awareness of climate change, and that due to it they need to re-think their own way of using energy; But they

acknowledge the lack of knowledge and certainty about how to make the changes, how to reduce their environmental impact and produce "healthy" vegetables. The city of Vienna representatives are also aware about the need for changes, but they still do not have a clear strategy of how to promote the changes, and how to implement SDGs.

The local stakeholders (the gardeners) think about FWE on a local level - with respect to their vegetable production, and their household costs. The global level is quite abstract for them, although they are aware about climate change. During our interaction it is necessary to always communicate about the intentions of our ULL, because they are strongly focused on their greenhouse production during their daily life. They are open to transdisciplinary approaches and to informing the public and involving their fellow gardeners from the association, if those are interested, however, the term "ULL" is not familiar to them, and also they prefer not to spend a lot of time learning about the methods the BOKU university partners are using. The two gardeners involved in the ULL acknowledge that there is a need to take a little risk (with respect to testing PV on their greenhouses), and to experiment with innovative ideas, because they would like to be involved in the energy transformation; they like to think of their production as a sustainable and closed loop system, and the mentioned the importance of working together with different societal actors towards the same goal.

Commitment

The two gardeners expressed full commitment - however, they have a chance to step out of the project, in case they feel uncomfortable with it. They agreed to provide access to the project-site, they are willing to participate in interviews, workshops, meetings etc.; they don´t have to put extra effort on a regular basis into their normal working routine, just on some occasions; they see the necessity of the project, so they are willing to participate. The BOKU and NIKKO PV are formal partners in the project, and have formal commitments. The city of Vienna is curious about the project, but we are not sure about the degree of their commitment, which might depend on the political environment and public discourse.

BOKU with its 3 institutes are "leading" the project, but the photovoltaic company NIKKO-PV also has a leading role (particularly with respect to the technical aspects) because of their expertise in planning, installing and monitoring PV.

Capacities (Expertise)

The relevant knowledge and skills needed to implement the ULL include: farming/horticultural knowledge, energy use/challenges, market conditions, technical aspects of PV and agricultural production. The participants involved in the ULL possess these skills and knowledge. The knowledge we aim to produce: systems knowledge - interrelations of food and energy, and other sectors, understanding of the FWE system (technical, ecological, material system), transformations knowledge - how to contribute to the empowerment of food producers, how to facilitate more efficient FEW systems in the urban environment; Target knowledge - energy efficiency, sustainable production.

Trust

To one extent, the scientific team is committed to full transparency with respect to all planned actions, data, ideas etc. However, some information provided by the gardeners constitutes sensitive information and should stay within the project group and not be shared further. This is very important

in order to maintain a degree of trust among the project participants, and in order not to pressure the project partners; No decisions are made without the agreement of all partners and all project aspects are discussed together at regular meetings

The gardeners have no financial risks and they don`t have to care about legal issues, legal framework etc. It is important for the project not to put extra responsibilities on the participants, in order not to overstress them with additional tasks, which are not part of their work.

The needs and knowledge and skills of each group are equally considered and valued when making decisions (equally); while BOKU takes responsibility for coordination, the power is equally distributed among the partners. The BOKU team is conscientious of the potential limitations, concerns and constrains which might come up from the other partners.

The participants trust each other; however, there may be some scepticism among the gardeners about the legal situation/city government/energy provider.

Support

The project is funded for 3 years, and it funds salaries of BOKU researchers and NIKKO PV, as well as technical equipment costs, However, the technical equipment cannot stay beyond the project lifetime due to the donor's requirements, and thus all construction has to be removed at the end of the project - or bought out by the participants, in case they wish to keep it. The gardeners are not paid for their time from the project, neither is the city of Vienna. The conditions of the support are tied to the rules of the funding programme.

Process

Experimental procedure

There are technical set-up requirements for the experiment to take place: setting up the PV panels on the roofs of the greenhouses, and setting up all the measuring equipment needed to gather data. Also, it is important to establish/co-produce an understanding of the FWE system in which the experiment and ULL are operating. Following the technical installations and the system understanding, the activities will include taking measurements and also public discussions, as well as participatory events aimed at understanding public perception about the agroPV installations. While certain activities are planned and structured, the experiment is managed in a way to allow for reflection, and also adaptation, in case new knowledge or unexpected processes require a change of actions, and thus the partners are open to potential emergent outcomes.

In addition to the technical data analysis, economic modelling will be done, as well as qualitative analysis of public perception. Moreover, systems analysis and scenario development methods will be used.

The experiment connects food and energy production in terms of sectors (as well as city planning), and in terms of geographical location it is linking rural with urban areas (city edge).

The experiment itself is focused on the local scale, however, it aims to initiate and contribute to discussion about energy efficiency in greenhouse production and independent energy production

within the agricultural sector (sustainable and local) not only on the level of the city of Vienna, but potentially beyond.

Transformational Rationale / Methodology:

The general approach involves visualization/implementation of AgroPV, and through this awareness-raising and public discourse on local energy production and use, coupled with food production.

Knowledge is co-created via regular meetings and workshops among project participants, as well as public events with broader participation by experts from related fields, as well the general public. Mixed methods, which are based in disciplinary fields, but also transdisciplinary methods are/will be used.

The project partners are envisioning a coupled food-energy system as a way towards more efficient and just energy and food production and use, and our experiment aims at testing a concrete approach to this, and at raising public awareness about the need for a more sustainable and just FWE system.

Transdisciplinarity

The BOKU coordination team meets regularly in order to discuss and decide on the project development. At the same time, BOKU colleagues are working closely with the gardeners and NIKKO PV on technical project aspects, and during joint meetings and site visits we inform each other about the progress and any questions, adaptations or decisions to be made. Joint meetings with all project participants take place regularly, and regular contact via the phone or email is maintained.

The experiment is complex and multi-faceted in scope, and thus it requires collaboration among the different university departments, the gardeners and the policy-makers. The collaboration is fostered through joint decision-making, regular meetings, and joint implementation of the different project actions. Also, the son of one of the gardeners, who is a student in a specialized gardeners school, has been involved as one of the researchers, and is basing his high school thesis on one plant-related aspect of the project - but the measurements he makes and provides are uses further by the project team and integrated in further research.

Interest of the actors are as follows: LGV Wien - to find possibilities to work in a more energy efficient way, to improve their marketing possibilities with respect to local/sustainable production, to become more independent from the energy provider; NIKKO-PV is interested to test a new kind of PV-panels and get data of efficiency; Urban Innovation Vienna is interested in identifying innovative projects and solutions to reach 2030-climate goals. BOKU partners are paid for their work as researchers in the project, and they are interested in co-producing new knowledge in the various fields related to FWE systems.

The involved gardeners can influence other fellow gardeners in their association, and can contribute to the association opening up to agroPV production; they can also contribute with their example to greater awareness of the public about agroPV. The project partners can call attention of various policy actors for legal framework for renewables, energy efficiency, zoning for energy production

Public perception is one of the central points of our experiment, due to the fact that it has been the limiting factor to AgroPV in Austria. We will carry out interviews with actors about acceptance

(challenges, possibilities) and what they feel personally and what experiences they have with AgroPV, moreover, public viewings, discussions and debates will be organized.

The experiment is integrated into the LGV (the community and association of gardeners), because it is implemented directly on the greenhouses of two of the gardeners. Moreover, the association representative is informed about the experiment and participates in some of the meetings. Other gardeners in the association are aware about the experiment and communicate with the involved gardeners about it.

At the moment all actors have the same time frame in the project.

Reflexivity and learning

The researchers and practitioners are learning directly from the experiments and the data, and sharing the data collected with the rest of the group, as well as explaining and discussing together what it means. After the first data is collected, more joint meetings will be organized in order to facilitate co-learning. Also more public events and discussions will be organized. Joint reflection and evaluation will also take place.

The experiment allows for emergent outcomes to a certain extent, but with the limit of the time, funding, knowledge and political will.

There are time- and financial constraints, which limit the tolerance for failure, however, allow for addressing challenges and technical difficulties.

Openness and transparency

The researchers and practitioners are learning directly from the experiments and the data, and sharing the data collected with the rest of the group, as well as explaining and discussing together what it means. After the first data is collected, more joint meetings will be organized in order to facilitate co-learning. Also more public events and discussions will be organized. Joint reflection and evaluation will also take place

Outputs

Capacities

To-date we already have one output: the gardener is monitoring the energy produced by the panel, and adjusting his energy use accordingly. We envision that as the experiment continues more learning about acting sustainably takes place. However, we will be able to evaluate and describe this only at a later stage. The other gardeners in the LGV association, and potentially even on a wider scale, could also learn from this experience.

Knowledge

We hope to learn about how (much) PV affects plant growth and how much energy can be produced, used and if it is an efficient way to support internal consumption of electricity. The experiment will also provide technical know-how (with respect to, for example, placing PV panels on a greenhouse, and maintaining them, accordingly), which could be used in replicating or upscaling the experiment.

Accountability and Commitment

We cannot answer this question at this time.

Physical structures

The experiment does transform the greenhouses, via experimental installation of PV panels of different types on them. The Greenhouses also have different formats. One of the PV panels installed is a highly experimental and innovative one.

Social structures

We cannot answer this question at this time.

Uptake (transfer and scaling)

OUTCOMES

The questions related to the outcomes can only be answered at a later stage of the project.

Socio-ecological integrity

We cannot answer this question at this time.

Livelihood sufficiency and opportunity

We cannot answer this question at this time.

Intra- and intergenerational equity

We cannot answer this question at this time.

Resource maintenance and efficiency

While we are aiming at contributing to greater resource efficiency with our ULL, we cannot answer this question at this time.

Socio-ecological stewardship and democratic governance

We cannot answer this question at this time.

Precaution and adaptation

We cannot answer this question at this time.

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Swedish Living Lab- Lund

Introduction

The Lund University Centre for Sustainability Studies (LUCSUS) is a core partner in the SustBeerLab, concentrating on promoting sustainability in the craft beer sector in the Skåne region of southern Sweden. SustBeerLab activities have developed down two pathways: the establishment and operationalization of sustainability principles for the regional craft beer sector, and the creation and testing of hydroponically-grown hops. LUCSUS hosted the second SustBeerLab event in late-January where nine craft beer sustainability principles were presented to brewers in the region, and where comments were solicited for each.

During the spring they plan to build a small test facility at the Brygghuset Finn brewery in Landskrona, Sweden to grow hops onsite, hydroponically, with ambitions to tie the hop growing to brewing process waste streams (e.g. heat, CO2). A hydroponic greenhouse will allow for a finer control of the growing conditions of the hops, with the aim to maximize productivity for each variety of hop. By integrating waste heat and CO2 from beer production, it may be possible to increase efficient resource use onsite, as well as to lengthen the growing season to 2 or even 3 harvests per year. Meanwhile, the launch of the sustainability principles on the regional Brewers Association website is progressing. This webpage will contain the sustainability principles, clear and detailed explanations, and is intended to have specific examples of strategies breweries can undertake toward aligning with each principle.

Setting

Environmental

Environmental factors are central to our activities. Overall brewer reliable access to ingredients (including organic), clean water, etc. is a strong determinant for resource use and import location. These conditions influence climate emissions for the sector, which we are, in part, targeting.

Social/Cultural

There is an underlying class, gender, and race (middle-class, white, males) that are broadly associated with the craft brewing industry (both for and by). Dependent on those with leisure time and disposable income. Though not completely - as there are growing craft brewing cultures in e.g. Japan. Basis for the "social" components of lab activities. Cracks, however, are emerging, especially with the race and gender components (e.g., gender ambassador, female brewing groups/female-operated breweries.

Financial/economic

Lab is strongly dependent on (esp. The experiments) external grant funding (e.g., Swedish Energy Agency and GLOCULL) for the participation of all partners. Swedish alcohol politics play an indirect role in this via stringent alcohol taxes.

Technical/Infrastructure

There is a dependence on natural gas delivery for the functioning of the brewery, accessible road transport, reliable quality water delivery, and water waste access. All of which is highly functional and available (Sweden). The lab will utilize all of these aspects. Generally robust in Sweden!

Legal/Political

Swedish alcohol politics, laws, etc. at the periphery. Defines the context in which the lab functions.

Organizational/Capacity

Knowledge, skills, training: Greenhouse design, construction, and maintenance; hydroponic hop growing; brewery technical functioning and intervention potential.

General profile

Location and Scope
Skåne, Sweden. Product distribution reach is mainly local but spreading. FWE resources spread between Sweden and rest of Europe. Eventually, global reach?

Purpose
To heighten awareness of sustainability issues, impacts and possible solutions in the Scanian craft beer industry. Experiment with different solutions. Experiment - To determine the viability of (1) growing hops hydroponically in Swedish climate with (2) multiple harvests per annum; and the potential of (3) using brewing production wastes - (3a) heat and (3b) CO2 - in the greenhouse; and to examine (4) parallel benefits in water and energy use efficiency in the brewery with the technical interventions needed for goal (3).

Activities
Capacity building, sharing experiences, (co-learning, co-creation), experimentation (to enable the 'purpose' as described above)

Timeframe
2017 forward.
No planned end-date.
Construction: Winter 2020
Hop growing: Spring 2020-Spring 2022

Organizational Structure
The determining of the Lab organizational structure is a collaborative process between different actors (depending on experiment or activity).

Participants

Lund University, The Regional Brewers Association, Individual brewing companies. Ingredients suppliers, others.

Background and History

In 2017, the original partners discussed and developed a plan to address problems each were seeing from their particular perspective combined with a desire to integrate more sustainable practices and principles in their production and business activities. A second industry partner, a factory with usable heat waste, has since dropped out due to internal reorganization and priority shifts.

Inputs

Awareness

Lund University: Well aware of need for radical systemic change overall, and the potential of transformation within the industry. Brygghuset Finn: Owner is partly aware of need for radical change, but it is not clear on what 'radical' means to them. Recognizes need and potential for change in the industry.

Commitment

Lund University: Strongly committed - e.g., Darin full time PhD; Brygghuset Finn: Sometimes, seemingly only moderately committed – with a primary focus on how this partnership can benefit their business (model).

Capacities (Expertise)

Lund University: Sustainable development, Transdisciplinary theory & practice, research time and experience.
Brygghuset Finn: Brewery functioning and production know-how.

Trust

There is a functional and growing degree of trust in the core group. The gap in motivations requires navigation - but is not unbridgeable. The payment to partner was not explicit enough to motivate specific actions and commitment to experiment at times - i.e. was not clearly delineated what activities/level and type of participation were expected from partner.

Support

Decent support through project financing, staffing.

Process

Experimental procedure

Experiment is divided into several phases: design, build, test. The design phase required several rounds of discussion between partners as to what was feasible to be done for what purpose. This required navigating purposes, motivations, funding, lofty ideas vs stark realities, system description (CLD), system function (flow diagram). Build phase - requires coordination around logistics, ownership, labor-hours, etc. Test phase - requires development, maintaining, and monitoring of experiment conditions inside greenhouse.

Transformational Rationale / Methodology

Approach and methods: Design phase - Transdisciplinary decision-making and commitment. Build phase - participatory collaboration. Test phase - Classic "laboratory" management Assessment - Trans and multi-disciplinary in learning, resource use impact, and other outcomes. (Trans - partners assess together; multi - partners assess apart). Overall rationale: within the industry - influencing what is possible for breweries to do and be.

Transdisciplinarity

Partners collaborate fairly evenly for decision making and knowledge sessions during the design phase (current but transitioning to build phase). These occur generally as meetings at Lund or at the Brewery. In next phases, most activities will take place at the Brewery, with responsibilities shared and allocated through negotiation and opportunity.

Reflexivity and learning

Learning has been central and shared e.g. during CLD modeling and Flow Diagramming - these examples serve to generalize as we get more familiar with each other's (partners') roles, interests, background, and expertise. There is no explicit learning agenda outside of the experiment's purposes. The experiment is highly adaptable within parameters.

Openness and transparency

As both partners are highly relevant to proceed at this time there is strong mutual participation in decision-making and experiment design. For other phases we anticipate the same. Channels of open communication exist where any information can be requested and shared.

Outputs

Capacities

CURRENTLY - To a moderate extent. Breweries are inherently motivated toward efficient resource use. But there is more that can be done - the experiment is building a habit of thinking in which ideas of what else might be possible is becoming more prevalent (evidence through general conversation).

Knowledge

X

Accountability and Commitment

X

Physical structures

Our project will only slightly impact the physical structures of the brewery, but the changes have a potential to make significant improvements in resource efficiency, while sustaining the greenhouse. The greenhouse itself will of course be a new physical structure.

Social structures

In terms of networks there is large potential through a webpage which we are hoping to create as a forum for craft brewers, to communicate the learning from our experiments, as well as others' experiences.

Uptake (transfer and scaling)

The potential for transfer and scaling is moderate. There are many advantages to local hop growing under controlled conditions, especially as climate change is making traditional hop growing locations less reliable (quality and characteristics) and viable (slowly but surely in many places). The adaptive and experimental nature of craft brewers lends itself well to adopting proven innovations.

Outcomes

Socio-ecological integrity

Overall, increasing resource use efficiency will make a tiny contribution to the ecosystems which interact with the brewing industry. The on-site hop growing will also make a tiny contribution lowering the need for traditionally grown hops, and their transportation. Any diffusion or scaling of this work will increase impact

Livelihood sufficiency and opportunity

The actor groups involved in the craft beer world are generally middle class. Craft beer is an element and example of the quality of life people in this class group choose. In that sense, this experiment is an example of how they can exercise their power and capabilities to advocate for a more sustainable value system embedded in their consumption habits. Hop experiment or principles?

Intra- and intergenerational equity

This experimentation is furthering the potential of small scale (SMEs in) food production to push the edges of sustainability practices - moving beyond efficiency into circular economy values.

Resource maintenance and efficiency

Overall, increasing resource use efficiency will make a tiny contribution to the ecosystems which interact with the brewing industry. The on-site hop growing will also make a tiny contribution lowering the need for traditionally grown hops, and their transportation. Any diffusion or scaling of this work will increase impact.

Socio-ecological stewardship and democratic governance

The lab engages many actors in various aspects of the brewing world in discussions, debates, and shared ideas/practices on the topic of sustainability - constantly building with eye for collaboration.

Precaution and adaptation

Early indications point to there are learning opportunities at almost all fronts.

More information

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Listen to the podcast at:

https://soundcloud.com/lucsus-lund-university/sustainable-beer-lab

American Living Lab- Arizona (Phoenix, Tempe)

Introduction

The goal of the Arizona Urban Living Lab (the ULL) is to develop a *sustainable food economy accelerator* that *amplifies and accelerates the sustainability of food enterprises* in Maricopa County. The AZ-ULL conducts a series of experiments (pilot projects) with local food economy actors to learn how such an accelerator would function and to institutionalize and scale the knowledge generated into a long-term operational organization beyond the lifetime of the ULL. Representatives of four organizations form a core partnership of the ULL: Arizona State University, Local First Arizona, the City of Phoenix, and the City of Tempe, with a variety of additional organizations participating in each experiment.

The ULL will focus on creating a sustainable food business accelerator/incubator/pollinator that advances local food sustainability by building capacity, making connections, and facilitating partnerships in and among local food enterprises and actors. The approach entails learning from existing sustainable food business front-runners (*best practices*) and using the acquired knowledge to build capacity in cities, support organizations, entrepreneurs, businesses, and communities to support startup and development of sustainable local food enterprises.

The envisioned accelerator/incubator/pollinator uses best practices to:

1. Advance the sustainability practices of sustainable food business front-runners
2. Improve the sustainability practices in existing aspiring food businesses
3. Incubate (pollinate) new sustainable food businesses (based on identified gaps)

Activities

1. **Compile a pool of sustainable food economy best practices** from Phoenix, Tempe, Arizona broadly, and worldwide. These are the best practices the accelerator will transfer to local business.
2. **Compile a pool of existing businesses and potential development projects** in Phoenix, Tempe, and Arizona broadly, aspiring to advance local food sustainability. These are the businesses (or proto-businesses) that will be accelerated by the accelerator.
3. **Design a capacity-building program for entrepreneurs and businesses** to create and run sustainable food businesses based upon transferring, scaling, and linking selected best practices from the pool.
4. **Conduct experiments** that deliver elements of the capacity-building program to entrepreneurs and businesses to build their capacity whilst learning about how to improve the program and what barriers sustainable food businesses face. Delivery goes beyond general capacity to support development of new project ideas.
5. **Design a capacity-building program for accelerator providers,** such as city government agencies and non-profit organizations, to run the accelerator, including how to deliver capacity-building programs to entrepreneurs to start and run sustainable food businesses; how to provide other support to overcome barriers to starting and running sustainable food businesses.
6. **Deliver provider capacity-building program** sessions to city and non-profit staff
7. **Institutionalize the accelerator**: Co-design with our partners the means to support ongoing operation of the accelerator after 2021 through policies, programs, organizational structures and so forth.

Selecting Experiments

The ULL partners will select experiments to conduct from the pool of existing businesses and potential development projects using the following guidelines:

1. Is exciting and of high interest to the ULL partners
2. Is impactful / transformational towards the goal of a sustainable local food economy
3. Is strategic for the development of the accelerator
4. There is a committed implementation partner
5. The needed capacity and resources can be acquire

Setting

Environmental

Water Supply - hot arid climate; Local groundwater overuse; local groundwater pollution; Water - flash flooding; water runoff / treatment capacity; Water - local (e.g. Salt River) and regional (e.g. Colorado river) riparian and wetlands severely environmentally degraded. Urban Heat - due to climate change and development, poses an increasing health problem (projected to be 45 days over 120oF);

Solar radiation: 340+ days of sun, very high solar energy generation potential; Native Sonoran Desert vegetation has high potential for food productivity and diversity.

Social/Cultural

Maricopa County is broadly equivalent to the Phoenix metropolitan area with population of 4.4 million and increasing (>15% growth since 2010). It has a high immigrant population (15% foreign born), especially Latin and many non-English speakers (26% from non-English speaking homes, mostly Spanish). Significant indigenous population and overall poverty (12% lack health insurance, 13% lack high school diploma, 13% in poverty) with concentrated areas of higher poverty, food deserts, low education, poor health, high incarceration strongly coincident with minority populations (e.g. South Phoenix). High prevalence of diet related health issues (obesity, diabetes).

Financial/economic

Strong economic focus by the dominant economic development community (e.g. cities, state Arizona Commerce Authority) on corporate enterprise and inward investment. Maricopa Co. has over 71,000 businesses employing more than 1.6m people with total payroll of $78 billion. Most of these (84%) are small firms of less than 20 employees, accounting for 14% of employment and 12% of payroll, whereas large firms with more than 500 employees account for only 4% of the total but 57% and 62% of employment and payroll. The middle ground makes up the rest with 29% of employment and 26% of payroll. The vast majority of firms in Maricopa Co. are Limited Liability Companies (LLCs) or general corporations, which includes single owner, family-owned, or other limited private shareholding firms, as well as a small number of employee-owned firms. A small number of corporations are publicly owned/traded. Cooperatives of any type are very few, and there is one very small worker cooperative.

Maricopa County's total agricultural sector sales by almost 2,500 producers was approximately $1 billion in 2012, of which $129m was for fruit, veg, nuts, and grains; $542m for me+D3at and dairy; and $318m for non-food, mostly feed crops. Retail food sales are dominated by a handful of national supermarkets and convenience stores. An estimated $400m of food sales in the Phoenix Metropolitan Area are organic (based on 4.5% national organic percentage of total food sales), whereas total food sales in Maricopa Co., excluding restaurants, amounted to $8.9 billion in 2017. Very little of organic sales are produced locally, with only 13 certified organic farms in Maricopa County in 2012, seven of which had sales of less than $5,000. More growers (102 farms - organic and non-organic) engage in direct-to-consumer (local) sales through farmer's markets and CSAs, though amounting to only $2m in sales. However, other local sales, to retail or restaurants, are estimated to be in the tens of millions of dollars. More recent data for local sales is likely to be a little higher. Food-related workers make up a major part of the Phoenix Metropolitan Area labor force of approximately 2 million in 2016, including over 9% working in food preparation and service, but are among the lowest paid, earning a mean hourly wage of $9.48. Although Arizona recently passed legislation to increase the minimum wage to $12 by 2020, this still barely meets the estimated $11.22 for essential living needs of a single person in the Phoenix area in 2018. Unemployment is at an eleven-year low of 4.2% for the metro area in 2018, but more than 16% of the county's population live below the poverty line.

Technical/Infrastructure

Vast expanses of low density, homogenous, suburban sprawl; Water system is highly centralized, large scale infrastructure and management; Very high per capita residential water use. Electricity is dominated by large scale, highly centralized generation controlled by a small number (2) of large utility

companies; Electric generation mix is diverse (coal, gas, nuclear, hydro) but very little renewable. Continuous loss of urban and peri-urban farmland to development; Many areas have little or no trees or green space;

Legal/Political

Maricopa County is historically a conservative (republican) county including significant representation of strongly held right of center views in the state legislature and many cities. The state legislature has been actively hostile to sustainability-oriented activity in the past. More recent demographic trends are decreasing the republican dominance of state politics. Cities are more likely to be democratic, including Phoenix and Tempe, and therefore more supportive of climate action, food action, community engagement and economic development, and sustainability more generally. Both Phoenix and Tempe have sustainability directors, and both have climate action plans (Phoenix: 2009, Tempe:2019) and Phoenix is about to release its Food Action Plan.
The regulatory environment broadly, is not helpful to urban farming or small food businesses, favoring more large producers and corporations. Urban farming, for example, faces barriers achieving agricultural zoning status (and tax relief it affords) and access to water. Local city codes make it difficult to participate in direct on-farm sales. Obtaining GHP/GAP certification is difficult and expensive for small producers, while small/micro food businesses find it very difficult to navigate myriad local codes. Recent years have seen the local food movement grow and strengthen, most likely as a result of several organizations including Local First AZ, Maricopa County Food Coalition, and Vitalyst Health, taking a lead, providing more organization and cooperation, and taking more broadly systemic actions.

Organizational/Capacity

Numerous (e.g. 15-20) organizations (non-profits, community groups, cities, academic/research groups, professional/industry groups) supporting development of local and healthy food, many of them with an emphasis on sustainable production. Not so many focusing on the food economy or enterprise development.

General profile

Location and Scope

The Lab is located in Phoenix/Tempe area. Lab activities primarily focus on the Greater Phoenix area (roughly Maricopa County) but may extend to the whole of Arizona when appropriate.

Purpose

The lab's purpose is to create a sustainable local food economy accelerator for the purpose of advancing the sustainable local food economy by influencing and assisting startup and existing businesses to push sustainability practices as far as possible, and by stimulating and assisting new businesses and services to fill strategic gaps in the local food economy. As an experiment in itself, creating the lab is a learning process that aims to create usable knowledge that will be used scale up (institutionalize) the lab and scale-out its services (expand reach and activity level) to continue operating post-project with greater impact, and to support other cities / regions to create similar accelerators (transfer).

Activities

The main activity of the lab is to conduct a series of diverse "pilot projects" (experiments) with local enterprises, entrepreneurs, and other food economy actors that will be capacity building and learning experiences for both the stakeholders involved in each experiment and for the stakeholders involved in creating the accelerator. In addition, pilot projects are expected to lead to concrete changes at the enterprise level (e.g. technology changes, new practices, new networks), and at the accelerator level (e.g. tools, resources, information, processes, organizations). More detailed activities within the lab will include:

- Building a database of best practices from existing sustainable food business front-runners to transfer and scale solutions
- Building a database of local food enterprises and actors and possible projects, and creating processes for designing experiments and recruiting participants.
- Conducting experiments to build capacity, make connections, and facilitate partnerships among local food enterprises and actors.
- Developing the accelerator elements, including programs it will provide, formalizing and generalizing material artefacts developed in, and lessons learned from, experiments
- Institutionalizing the accelerator, preparing for moving it from development / pilot project, into full operation
- Overall ULL management
- Setting direction of the overall ULL

Timeframe

The lab began in late 2018 and will complete its work by summer 2021 (end of GLOCULL) when it will transition the accelerator to new operational organizations.

Organizational Structure

There are four partners in the lab. One of them (ASU) takes the lead in managing the overall project. Partners select experiments together. One or more partners take the lead in each experiment but other partners are also be involved. Each experiment also includes one or more local business or group of local stakeholders.

Participants

1. ASU - Primary LL Partner. 4 academic staff (aggregated total ca. 1.0 FTE) from Schools of Sustainability and Future of Innovation in Society with established track record of local stakeholder engaged projects and research in climate change, water and sustainable local food economy. ASU is the largest partner and most knowledgeable with respect to broader aims of the lab, the concept of living labs, experiments and so forth and as such, tends to be the leader in setting the direction and managing the LL. Roles: setting direction, research, project management, stakeholder engagement, experiment design and conduct, accelerator development.
2. Local First Arizona - Primary LL Partner. 2 staff (director plus sustainability projects manager, ca. <0.5 FTE total). Mission is to support and grow the local economy. They have strong connections to local business community and strong commitment to sustainability with

several closely aligned programs. Roles: setting direction, stakeholder engagement, experiment design and conduct, accelerator development.

3. City of Phoenix - Primary LL Partner. involvement of up to 4 staff (mainly Environmental Programs Coordinator, but also Sustainability Manager, and others from neighborhood services. <0.5 FTE total). Phoenix is generally supportive of local food efforts and has many connections with local food businesses, community groups, and support organizations in the city, and is creating a Local Food Plan. Roles: setting direction, stakeholder engagement, experiment design and conduct, accelerator development.
4. City of Tempe - Primary LL Partner. involvement of 4 staff (Sustainability Director and Local Food Coordinator, <0.5 FTE total). Tempe is increasing its support for local food efforts with the recent creation of a staff position, and is making local food a key part of its Climate Action Plan. Roles: setting direction, stakeholder engagement, experiment design and conduct, accelerator development.
5. Other Organizations - Supporting LL Partners. None engaged yet. Includes organizations providing needed services (e.g. water systems,), or generally supportive and complementary purposes.
6. Experiment Participants - local food enterprises (for-profit, non-profit, community-based, etc.) with commitment or aspirations to sustainability goals; Entrepreneurs interested in starting sustainable food enterprises; experts with specific capabilities.

Background and History

The lab was formed in 2018 from pre-existing elements (existing partnerships between the main partners, existing projects each partner was involved in).

Inputs

Awareness

Participants are strongly aligned about the need for a sustainable local food economy, although their respective organizations do not share the same level of awareness or views with exception of Local First Arizona. There is also likely some divergence among partners on some of the details of what a sustainable local food economy is, the scope of the accelerator, and so forth. For example, partners may differ in their emphasis on material flows (e.g. energy and water and waste) compared to employee-ownership and democratic control.

Commitment

All of the lab partner organizations have shown strong commitment in the early stages of the projects. Each partner has assigned existing staff in leadership positions and hired additional staff to carry out project activities, and brought in other staff on a more occasional basis. Partners are responsive to communications and attendance at meetings has been good and contributions made. The main basis of the commitment is likely: each partner received significant funding to participate in the project; strong alignment with each partners' current interests and projects. Commitment of experiment participants (e.g. entrepreneurs or existing businesses) has yet to be tested. Initial activities to recruit participants indicate interest but it is not clear in how far this will translate into commitment.

Capacities (Expertise)

The **lab partners** bring significant capacity required for lab activities:

1. ***Skills:*** stakeholder engagement and relations; project management; analysis and research; training and other capacity building program development and delivery; sustainability assessment of businesses; outreach;
2. ***Experience:*** all partners have multiple years of experience working in the local food field and engaging in projects with stakeholders; Also extensive experience in conducting workshops;
3. ***Knowledge:*** very extensive knowledge of the local food economy; very extensive networks of local food business, organizations, and individual actors; extensive knowledge of sustainable food enterprise best practices and exemplary businesses; local government regulatory and administrative knowledge.

Experiment participants (entrepreneurs, businesses, support organizations, etc.) may also bring some of the above skills / experience / knowledge, but their primary capacity is: technical or marketing or creative or business development skills, related to the business or project; specific business knowledge and general business development knowledge. Experience, is likely to vary from very little (e.g. new entrepreneurs) to very much (existing business, support organizations, etc.)

Trust

Between lab partners there is a good level of trust that has built up through working together on previous projects going back several years and more. There is some power imbalance in that ASU is more in the driving seat due to greater knowledge of the overall project goals and objectives and has been the primary designer of the project. However, it would appear that other partners are somewhat happy for ASU to take the lead in this respect (relying on their judgment and capacity), but will play a more active role in overall steering of direction. Trust with experiment participants is not expected to always be developed to the same level as it is with lab partners. On the positive side, many experiment participants are likely to be known to at least one of the lab partners and so some positive relations is already there. Also, the lab partners have positive images with many involved in the local food economy, Local First in particular, has a strong reputation with small businesses. However, on the negative side, the lab partners are mostly white, non hispanic, that may present some barriers when working with minority populations. Also, ASU and the city lab partners at full organizational level, regardless of individual relationships, do not have a high level of trust with some sectors of the population.

Support

The lab partners have all received funding to support some level of staffing for the project. For ASU, this amounts to approximately 1.0 - 1.5 FTE and for the others, to less than 0.5 FTE, over two years. Each organization is also able to provide facilities (e.g. meeting rooms), services (e.g. outreach through existing media channels) and make minor contributions from other existing staff, especially where there are overlaps with other projects, or maybe for funding opportunities through existing contacts and discussions. These contributions are made under the control of the partner organization. For experiments, there is no financial support being offered to participants. Participants will be expected to make significant contributions to projects, whether in terms of staff time, access to facilities, capital costs.

Process

Experimental procedure

The lab has not formalized its experimental procedure and will develop this while working through a series of experiments. At this point, the thinking is that it will use a general procedure for each experiment along the lines of the following:

1. Initial exploratory discussions with possible participants
2. Agreement on (*co-creation of*) general experiment areas / goals, roles, expectations, commitments, etc. *within the aims and objectives of the accelerator*
3. Baseline assessment(s) suitable to the general experiment areas
4. Detailed co-design of intervention significantly informed by the baseline assessment,
5. Design of experimental aspects (e.g. learning objectives, theory of change, variables, measurement, data collection, ...)
6. Implementation of the intervention
7. Data collection / measurement
8. Evaluation and interpretation of results
9. Reflection

Transformational Rationale / Methodology

The overall approach of the lab is to conduct a series of experiments to learn about how to effectively build capacity among local food actors to develop sustainable enterprises and economy solutions, and to institutionalize the lessons learned in a sustainable local food economy accelerator. The rationale is that

(1) by building capacity of entrepreneurs and businesses, new businesses will be formed or existing business changed to adopt more sustainable practices, and connections will be created or strengthened that support and increase the sustainability of other enterprises;
(2) by creating an accelerator, the knowledge, skills, and resources needed to deliver capacity building services to entrepreneurs and businesses is strategically concentrated and coordinated in a way to maximize effectiveness;
(3) by institutionalizing the accelerator, it continues to build the sustainable local food economy after the lab ends towards significant (transformational) levels;
(4) by building broad-based sustainability capacity in businesses, sustainable FWE practices will be realized in the long-run, if not as an immediate objective of experiments.

Specific aspects and methods of the intended approach (though not all in-place and formalized at this point) include:

- the lab is a collaboratory endeavor between a coalition of diverse stakeholders that bring broad experience and knowledge (transdisciplinary)
- the lab defines and agrees upon a broad high-level vision of a sustainable local food economy that sets the goals and constraining parameters for experiments (pragmatic transformational sustainability research)
- the lab draws upon existing research, extensive knowledge of lab partners, and specific input from other stakeholders, to identify gaps, opportunities and intervention points in the sustainable local food economy (pragmatic transformational sustainability research)

- experiments engage lab partners and local food actors in co-design and execution (participatory)
- learning from existing sustainable food business front-runners to transfer best practices (solution-oriented research)
- experiments are strategically selected to target promising intervention points in the local food economy
- experiment participants are selected to have a high level of commitment to complete the experiment, to learn from it, and to act on learning.

Transdisciplinarity

Due to historical development of the project, and the knowledge, capacity and resources of the main partners, ASU has taken the lead in forming the lab, setting the direction, and managing work. For example, ASU: forms and documents rationale and conceptual framework; defines the workplan; calls and schedules meetings sets agenda; hosts meetings at their location and facilitates meetings; defines methods and data collection structures. Decisions are made by all partners in plenary meetings but always led by ASU (what is the decision to be made, how is it framed, how will it be made). In selecting experiments to conduct, there has been an attempt to adopt a somewhat objective process based on collecting standardized information on possible experiments and using a set of criteria to evaluate them, yet the criteria and information to be collected were largely defined by ASU. While these have communicated and discussed and adapted, other partners have not had the time and fuller knowledge needed to really make a meaningful contribution to the development of criteria and decision making procedures and so forth. As such, experiment selection may reflect ASU's interests more than others.

At the experiment level, participants (i.e. businesses, entrepreneurs) will be invited and encouraged to participate in defining experiment goals and objectives, designing experiment details, implementing experiment work tasks (e.g. making physical or organizational changes), and measuring / collecting data. Some of these tasks will be impossible without a high degree of involvement from the business participants.

Reflexivity and learning

Reflection and learning are not formally defined within the lab. However:

- a primary objective of the lab to learn about how to effectively build capacity for advancing the sustainable local food economy.
- lab activities, including experimental procedures, have not been rigidly defined at the start, but are being developed over time; it is intended that reflection on activities will take place at multiple times and will be used to adapt methods / procedures moving forward

Openness and transparency

Project documents, including concept notes, meeting minutes, presentations, collected data and so forth, are generally shared by email to all partners. Additionally, a shared Dropbox folder is used store project documents, though this can sometimes be troublesome to access and may not always be easy to find specific documents or documents may not be up to date.

Outputs

Capacities

The lab's primary purpose is to build capacity of experiment participants (entrepreneurs, business owners, workforce) for sustainable business development, and for lab partners about how to generalize, transfer and scale sustainable business practices.

Knowledge

A primary objective of the lab is to learn what works or does not work from each experiment in order to create a coherent set of programs that can be used to deliver capacity building services to enterprises in an ongoing, consistent, repeatable fashion. Each experiment generates knowledge about what capacity needs to be built, how to build that capacity, and specific substantive knowledge that needs to be imparted. The knowledge generated is "packaged" in the form of procedures, tools, materials, training programs, networks, information, models, and such like that can be used in multiple ways to support sustainability capacity building in other enterprises.

Accountability and Commitment

Accountability and commitment depends on a number of "soft" incentives and screening for good fit. Recruitment of participants (entrepreneurs or enterprises) for experiments includes consideration of their motivation and seriousness to take part and see it through, making clear the resources (time, effort, money, facilities, etc) they are expected to provide, and the resources that the lab partners are putting into the experiment. During the experiment, participants will receive feedback and encouragement and after the experiment they can receive ongoing support and are obliged to provide periodic updates on their progress.

Physical structures

For some experiments, generating generate physical changes will be a primary output. For example, upgrading water systems or energy equipment, or to introducing an electric cargo bike mode of distribution. Mostly, physical changes are secondary outputs outside the immediate activities of the experiment, that result from capacity building of participants.

Social structures

For some experiments, generating generate social changes will be a primary output. For example, connecting stakeholders to form new networks, or assisting participants to form a new business entity. Mostly, social changes are secondary outputs outside the immediate activities of the experiment, that result from capacity building of participants.

Uptake (transfer and scaling)

Uptake is a primary objective of the lab, or more exactly, of the accelerator that it is developing. The experiments conducted within the lab will include testing and developing uptake mechanisms, procedures, methods and such like. Each experiment will therefore include an explicit step to generalize lessons learned and to make the knowledge useful for facilitating up-take. This could, for example follow the method of Forrest et al. (2019) to identify key success factors within a contextual framework, to perform extrapolation exercises, and conduct systemic effects thought experiments.

Outcomes

NOTE: At the time of writing this description of the Arizona ULL, there have been no appreciable outcomes. What is described here, therefore, are generic descriptions of the type of outcomes that the AZ ULL anticipates and aspires to. These then become, to some extent, form the basis for design guidelines for the experiments and overall lab, and then as evaluative criteria to post-experiment/lab evaluation.

Socio-ecological integrity

More enterprises adopt some operational practices that do not damage or that regenerate the environment. Existing enterprises adopt more environmental sustainable operational practices and push these practices further. Scope and nature of such practices may include:

- Supply chain sourcing of organically / sustainably farmed ingredients
- Locally sourcing ingredients / products
- Switching to lower water use ingredients
- Internal process efficiencies (see also productivity)
- Utilizing local renewable sources of energy and water (e.g. onsite renewable energy generation, onsite rainwater capture)
- Engaging in system-wide schemes to ensure reduced water / energy input results in environmental benefits

Livelihood sufficiency and opportunity

(1) Enterprises are created or adapted to produce fresh, healthy food that meets people's basic nutritional needs while simultaneously ensuring basic needs for water and energy are also met.
(2) Enterprises are created or adapted to produce fresh, healthy food that meets people's enhanced needs for a good quality of life while simultaneously ensuring basic or enhanced needs for water and energy are also met.
(3) Enterprises are created or adapted to support subsistence activities, such as growing food, cooking or producing food, or exchanging food or ingredients or other materials for direct individual, family or community use.
(4) Enterprises are created or adapted to create meaningful jobs, generate financial surplus, or increase local trade and economic activity

Intra- and intergenerational equity

(1) Enterprises are created or adapted that support the ability of people in other regions to provide for their basic needs, livelihoods, economic opportunities, and to regenerate their local environment. Concepts of justice may be extended in the enterprise's mission to recognize rights of other species and the environment. This would include the enterprise taking an active role in broader societal activities such as community volunteering or political advocacy, to protect these rights.
(2) Enterprises are created or adapted such that the social, economic and environmental benefits are fairly distributed and make a positive contribution to redressing existing inequities by making special provision to include and make accessible the benefits to those who need it most. For example, access to fresh healthy food is specifically targeted at food deserts; food, water and energy are within low-income family budgets; jobs are created in areas with low

employment prospects; enterprises prioritize creating community wealth, rather than just jobs.

(3) Enterprises are created or adapted such that they do not borrow water, energy, nutrients, land, wealth, labor, and such like from the future in order to produce food today. The mission of the enterprise may be written to legally require future rights of people, species and the environment to be protected. This would include the enterprise taking an active role in broader societal activities to protect future rights.

Resource maintenance and efficiency

Food production and distribution (farming, transport, processing, etc) minimizes material inputs, uses local renewable inputs, incorporates closed loop systems. The enterprise enters into partnerships or organizations that enable such efficiencies at greater scales and outside the scope of the enterprise's operations.

Socio-ecological stewardship and democratic governance

Enterprises are created or adapted such that all workers or members are empowered by having an equitable part in decision making at all levels (operational, management, strategic) commensurate with their activity levels within the enterprise or degree to which they are affected by the enterprise. The enterprise is also required to consider the rights of other people, species and the environment who cannot be directly involved in decision making by, for example, appointing a board member to be their representative. Enterprises are also created or adapted such that they take a long-term view and consider the rights and impacts on all future workers or members or communities, or on other species and the environment. For example, enterprises may assign a board member as a specific guardian for the future.

Precaution and adaptation

Enterprises are created or adapted such that they build in: education about broad-based sustainability and local/global impacts related to enterprise operations; periodic reflection about the enterprise sustainability performance; staying informed about social / environmental / economic / political events and trends; taking action within the enterprise to change operations; actively intervening outside the enterprise; forming partnerships and being member of associations that can help to understand possible future problems and solutions.

More Information

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South African Living Lab- Kayelitsha (Capetown)

Introduction

The South African ULL is situated in Khayelitsha, the largest township in the Western Cape. Townships are South African under-developed urban areas that were strictly reserved for black African people during the apartheid administration era. Khayelitsha is known for its high levels of urbanization, poverty and crime, far removed from the mainstream economic activities in Cape Town. These dynamics coupled with the lack of locally produced food and the presence of extractive supermarkets are the main drivers of food insecurity in the township. The activities of the living lab are structured around issues relating to food security, unlocking sustainable food consumption patterns and food entrepreneurship. In order for the research intervention to drive change it was necessary to co-produce relevant research strategies in collaboration with community stakeholders. Sustainable, healthy food and entrepreneurship were identified as the most important points of intervention by all of our community stakeholders.

The main activity of the South African ULL is the establishment of a healthy food market called Impilo Yabantu Market (IYM). The initial goal of IYM was to co-create an educational space geared toward spreading awareness of healthy food and the importance of a healthy diet. In 2019, a total of 4 markets were held in Khayelitsha with mostly local vegetable and fruit growers and chefs from within the community. Interest from community is growing. Since the initial inception of the market went quickly, the IYM has evolved into a platform for local social entrepreneurs, artists and community

members to develop and promote their own brands, talents and ideas toward a common good. The scope of the ULL shifted towards the realization that a market needs more than just food to attract the local community's interest. The expanded scope of the IYM includes finding ways to support and develop the initiatives of local social entrepreneurs. As a result, the researchers and local partners are working with a wide range of social entrepreneurs some focusing on sustainable grown food, art, but most of them are engaged with issues around food and urban gardening.

A second activity of the ULL includes meetings and facilitated focus groups with local partners through which feedback of the markets, interrogation of the context, and challenges faced are discussed. The intention of these engagements is geared towards further co-creating a sustainable food market in a poor and under resourced community. Lastly, the IYM hosts a number of workshops and networking opportunities aimed toward building the capacity of all stakeholders. The ULL is structured on the premise that change must come from within the context where the challenges are experienced.

The ULL therefore consists of three locally imbedded post-grad students and a network of change makers and social entrepreneurs from Khayelitsha. Through this network the IYM hopes to empower all of the ULL members, to educate and inspire other community members to take action, to collaborate with relevant stakeholders and to co-create local solutions to global problems. The activities of our ULL is fundamentally of a range of safe-to-fail experiments in support of the initiatives of local stakeholders.

Setting

Environmental

The Impilo Yabantu ULL is located in Khayelitsha, an expansive, low-lying, flat area and over-populated with minimal land available. It has poor environmental conditions (sandy soil, wind exposure, exposure to environmental risks, flooding and pollution. Khayelitsha has a legacy of apartheid South Africa. The area generally has poor and aging infrastructure with a fast growing informal settlement area to accommodate the high needs of housing. In the absence of open spaces, a local primary school offers space for the creation of a garden to grown vegetables sustainably. Urban garden.

Social/ Cultural

There is education and cultural diversity, with mostly low education qualification. Majority of residents migrated from a neighboring province is search of better economic opportunities. There are high rates of unemployment and food insecurity.

Financial/economic

Because of high levels of unemployment, most residents are poverty stricken and highly dependent on social grants. Most residents are physical and economic exclusion from main economic activity and

opportunities in Cape Town. Funding for the ULL comes from the foreign donor community and is limited to achieve overwhelming challenges faced by community.

Technical/ infrastructure

Khayelitsha and the primary school where the markets are held both have very poor infrastructure and service delivery. Apartheid Spatial planning left citizens to develop own infrastructure or live without it. And caused people to live with every poor quality of infrastructure.

Legal/ Political

The team mainly has social entrepreneurs, change makers, activists as local partners.

Organization/ capacity

The ULL has limited skills and as result, attempts have been made develop skills and capacity. A general lack of organizational and capacity factors is the central challenge faced by ULL and beyond. Networks are probably the main strength however, they are currently underutilized by local partners. There is generally a strong sense of community and cooperation.

General profile

Location and Scope

ULL is not necessarily geographically bound, but most activities take place in urban garden. Aim is to further expand activities and experiments more to other parts of Khayelitsha, stakeholders all come from different areas, but mostly based in Site C (change could impact people in respected communities of stakeholders). The changes that the ULL strive to achieve will take place on a personal level in different areas of Khayelitsha. If experiments are further rolled out and formalized the changes could be observed in various parts of Khayelitsha. (gardens, workshops & events). stakeholders all come from different areas, but mostly based in Site C (change could impact people in respected communities of stakeholders).

Purpose

The main purpose of the experiment is to foster a holistic healthy food environment in Khayelitsha and to contribute to economic and entrepreneurship development. Food and Water (future possibility of energy) have been a great focus in light if the water crisis experienced in Cape Town. The ULL mainly applies principles of co-teaching, learning from each other , co-creation and collaboration.

Activities

Experiments are nested in the activities of ULL. The ULL consists of management team comprising of researchers and local partners. All activities that are carried out by and for management team could be considered as experiments toward achieving our overall purpose.

Timeframe

2019-2020/2021. The project started in 2019 and the aim is to ensure that it continues indefinitely. The involvement of the current research group will however end at the end of 2020. There is an interest of possibility of involving students in the future.

Organizational Structure

An informal procedure of establishing the roles and responsibilities was initiated at the start of the project. A formal processes was avoided at the start in order to limit stronger institutions such as the

University of Stellenbosch playing a big brother role. Currently the management, made of researchers and main local partners take formal responsibility, but this is in the process of shifting towards a more formal organizational structure that can ensure sustainability of the ULL. The co-leader/leaders is in constant flux. It is rather challenging to develop a leadership structure given the context of the community as well as the role reputation of the university.

Participants

Besides the local partners which make up management with the researchers, the ULL consist of community stakeholders which include entrepreneurs, artists, gardeners and activists. More recently private organizations and government departments have shown interest.

Background and History

The process is emergent as the ULL attempts to navigate the complexities of the local context. The experiment has gone through several challenges with the roles of researchers (mainly shifting between researchers, facilitators, mediators and activists) and collaborators constantly in flux. Creating stability on leadership structure that can enable ownership of the ULL is currently a priority.

Inputs

Awareness

There is an awareness of the need for changes into FEW, but due to limited capacity the scope is focused on one aspect of FEW (food) as a means to bring about wider systems change.

Commitment

Participants communicate their commitment, but when it comes to implementation there seems to be a lack of commitment. This appears to be changing with assemblage of new management team with wider awareness and commitment. The co-leader/leaders is in constant flux. This is partly because a formal leadership structure was not established. The ULL is in the process of changing this as team becomes more formalized.

Capacities (Expertise)

The main knowledge used in the ULL is that of understanding the immediate context. The most important thing is to understand when conducting transition experiments in this context is to gain an in depth understanding of the context first. Knowledge that has been produced has emerged as a result of a continual effort to implement the market. New knowledge has also been co-produced as a result of social cohesion (making connections between different people) and workshops. Some of the stakeholders possess the necessary will and passion to carry out the process and why it is necessary, but we have observed that there is a major need for skills development, which is why it has become one of our focal points.

Trust

There is a large extent of personal trust and strong relationships. But some partners tend to hold back and do not necessarily speak openly for multiple reasons. These may include culture, context, positionality, lack of leadership and having a main partner as an academic institution. This is something that researchers aim to address to enable a more collaborative environment. The intention from the beginning was for all stakeholders to be on equal footing with no skewed power relations. In reality,

there are power dynamics which are constantly shifting and new leadership structures emerging. What has been critical in fostering trust is to constantly reflect and thrive for honest conversations.

Support

There is very little funding available for experiment. The funding is controlled by researchers and was mainly used to participate in GLOCULL activities, some was used to initiate and continue the market, as payment for main stakeholders and to host workshops. The budget runs until 2021, but mostly for administrative costs. There is a need for more funding if the experiments are to be continued. Gaining funding with community stakeholders could be seen as an experiment in itself. Transport (researchers), personal funding (researchers and community stakeholders) and community cooperation and support. One interesting/positive change is the fact that new stakeholders are seeking support, funding and collaboration from other actors independently from researchers.

Process

Experimental procedure

The experimental procedure is complex as the team makes adjustments when necessary. The experiment is mainly around executing a sustainable healthy food lab in a challenging environment with local partners. Making adjustments can at times cause conflict between stakeholders. The most challenging adjustments came expanding the scope of the market from solely focusing on food to including the agenda of social change.

Capturing of these experiments is done through facilitated reflection sessions, data gathering (interviews, surveys, questionnaires, conversations and story-telling), recording of meetings and conversations.

Important aspect in initiating the experiments was for all the partners to build relationships and later implement the market to see what would emerges. The exit strategy is to shift roles of researchers away from hands-on logistical involvement to facilitators of the discussions amongst the local partners. One of the aims of the experiments conducted is to bring people from different cultures and backgrounds together in places they have never been. To break misconceptions and build cultural bridges (e.g. Khayelitsha Township with Cape Town and people within Khayelitsha). The team comes from different areas of Khayelitsha and have to navigate misconception in order to participate effectively.

The experiment focusses on addressing local challenges experienced in the context. The link lies in the similarities in the challenges experienced by low-income communities across the world. We are simply doing what we can with what we have and believe that this is an appropriate way for change makers in low-income communities to mobilize, innovate and learn toward bringing change. The initial experiment was to establish first market. New actions are decided on as new challenges emerge. No real sequence.

Transformational Rationale / Methodology

The experiment aims to achieve social change on an incremental level. Learning by doing, listening to stories, experimentation, workshops, reflection, data gathering. Emergent TDR, problem analysis, Action research? Questionnaires, surveys, ethnography. Food is a central component of FEW around which people mobilize and discuss further challenges and ways to act. To an extent it has highlighted valuable insights due to trials and tribulations and reflexive thinking of TD team. The idea needs to be refined if it were to be transferred to other contexts.

Transdisciplinarity

In the context of the Cape Town ULL, transdisciplinary encompasses sustainability science, co-creation, nutritional science, agriculture, entrepreneurship, social development, tourism. Each researcher formulated own research question in collaboration with community partners or based on knowledge generated through embeddedness and experiences in the context. In the process of co-

creation, power is equally distributed, but constantly shifting as the experiment unfolds. The initial experiment acted as a platform that brought partners together. Now it has reached a point where effective collaboration is one of the key values. Partners have begun to collaborate with other actors (government departments and potential funders) independently from researchers. Main stakeholders and drivers of experiments are community partners and researchers. In the future, the team see increased involvement of other local stakeholders from 2020. The main interest of local partners lie in their passion to bring about positive social change and to generate income to themselves and their community. Different partners contribute to these changes in their own capacity. Experiment is geared toward community, but community integration has been very limited due to various reasons

Reflexivity and learning

Almost all of the consequences are unintended and emergent. The approach of the team manage emergent nature of the ULL to enable a space for failed experiments. This requires a good working relationship between the partners and willingness to not committing to a single structured approach. As part of holding the emergent nature of the ULL, a leaning process through reflections and evaluation of the process have to be conducted often. The learning process is induced by team based on an identification of needs and new challenges.

Openness and transparency

The first stage of starting the ULL entailed building a relationship between the team. This process was mainly between the researchers and the main local partners. Trust between the partners has been affected by the emergent nature of building the ULL the and the assumption that there is trust, respect and transparency in the team has been shifting.

Outputs

Capacities

Yes

Knowledge

Systems knowledge, particularly between the scientific and societal, are being integrated. Insights on conducting TDR in challenging environments are emerging.

Accountability and Commitment

Although the leadership structure has not been formalized and trust tends to shift, there is accountability and commitment from all partners. This has ensured that so far there is continuity of the experiment.

Physical structures

No

Social structures

Social structures that ensure the continuity of the ULL have been established. They are key in driving and changing the narrative about food.

Uptake (transfer and scaling)

IYM team from different areas in Khayelitsha and one of the target groups is 'outsiders'. Main aim is to address local challenges, which often relate to global challenges. Experiments are kept incremental to minimize risk. There is a possibility to sustain the IYM and to expand it to other parts of Khayelitsha.

Other townships in South Africa, with similar challenges, are also experimenting with the idea of markets. There is potential for IYM to exchange lessons with other markets in the country.

Outcomes

Socio-ecological integrity

There is very little impact in terms of FEW, but other forms of social change such as social cohesion, capacity building, education (gardening, recycling) have been observed.

Livelihood sufficiency and opportunity

The outputs have impacted people's lives on a very incremental way. However, there initial goals initially set up have been slow to achieve. But due to intervention of stakeholders, there is now ownership of the platform which they could use to exercise their powers and capabilities to bring about social change, one step at a time. Still too early.

Intra- and intergenerational equity

This is one of the major goals, but have not achieved it. The experiments attempt to bridge the culturally/racially induced gaps prevalent in South Africa. But due to our size, context and capacity , this can only be achieved in incremental scale.

Resource maintenance and efficiency

The experiments are based on/driven by the principles of sustainability and through them hope to educate the youth and the wider community on food systems and other issues.

Socio-ecological stewardship and democratic governance

At the moment it is still too early to say. But our ULL consists of local community leaders and change makers and our aim is to build their capacity.

Precaution and adaptation

The process of the intervention has been a learning journey for everyone involved. Given time, the team would have take more precautionary measures at the start of the project.

More information

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German Living Lab- Lüneburg

Introduction

The GLOCULL project in Lüneburg is set in the context of an ongoing process between local actors from the civil society and the local economy, the city administration and the university, that over the past four years has been establishing a large scale real-world laboratory. In this lab called, Lüneburg 2030+, 15 sustainability experiments will be carried out to foster sustainability transformations and development local solutions that enable the city of Lüneburg to contribute to reaching the Sustainable Development Goals. These 15 original "2030+ experiments" are large-scale processes and aim for a broad public participation.

Through the GLOCULL project, there is the opportunity to design and conduct additional experiments with a particular focus on issues in the Food-Water-Energy Nexus (FWE). Hence, GLOCULL can be understood as a more specialized laboratory within the large 2030+ real-world laboratory. The GLOCULL experiments are being driven by smaller teams (3-5 partners). Currently, the first GLOCULL experiment is in the co-development and planning and will start into the intervention phase in January 2020. The experiment addresses the use of clean energy in the local small business sector. Further experiments will focus on co-developing sustainability interventions for local coffee businesses and craft beer breweries.

All of these experiments will be co-designed by academic and non-academic actors and address local real-world sustainability challenges. Through a more leading role of the researchers in the co-development of the experiments, the experiment design will benefit from knowledge generated in

other ongoing GLOCULL experiments that also deal with challenges in the coffee and craft beer business sector.

Setting

Environmental

Lüneburg with an area of about 70 km² is located very central in the northern part of Germany. It lies in the mid-latitudes and in between the continental and maritime climate (Deutscher Wetterdienst). The city of Lüneburg is build on top of an underground salt dome which lead to great prosperity and wealth of the city in the past (lüneburg.info). Besides the mixed forests, Lüneburgs surrounding landscape is dominated by agricultural and some small industrial areas. Nearby the biotope of the famous Lüneburg Heath is located (google earth).

Social/ Cultural

Lüneburg has about 77.500 inhabitants (Website of the City of Lüneburg). 6.8% of people living in Lüneburg are immigrants which is relatively low compared to Germany as a whole with 13%. Due to its long central European history, different branches of Christianity are still the prevalent religion (Zensus Data). Furthermore, green and social democratic values are common among Lüneburg's population. (derived from the composition of the city council) In 2014 the city of Lüneburg and the Leuphana University won the German Sustainability Prize (Website of the city).

Financial/economic

The industry of Lüneburg largely consists of small to medium sized businesses. The inner city is dominated by smaller businesses, the companies in the industrial areas are mostly medium sized. The unemployment rate of Lüneburg is 5.2% compared to German wide 4.9%. Employment is currently at 55.2% compared to Germanys overall 58.7% (Arbeitsagentur Statistik). Around 11,000 companies were reported in the district of Lüneburg in 2015 which provide jobs.

Technical/ infrastructure

The market of electricity providers is divided by multiple providers. One of them is the local provider LÜNESTROM which focusses on green and fairly produced energy. Purena GmbH is the local water provider in Lüneburg. They are part of Avacon AG, one of the many electricity providers in Lüneburg (avacon.de). Regarding food, twice a week Lüneburg hosts a central farmers market on the town hall square and about 20 supermarkets (Google Maps) In addition, the district of Lüneburg has about 150 restaurants of which 13 categorized themselves as coffee places (tripadvisor). Waste management in Lüneburg is done by the AGL and by GfA. AGL is responsible for the treatment of wastewater AGL Website) whereas GfA collects waste disposals from households in Lüneburg (GfA Website).

Legal/ Political

The city government of Lüneburg is the city council which has currently a majority of a social democratic and a green party. The city mayor has been the same since 1991 (Website der Stadt Lüneburg).

Organization/ capacity

The Hansecity of Lüneburg and Leuphana, its university are cooperating often in projects with common goals(Leuphana Website). Out of this history of cooperation a strong relationship between the city and ist university has developed. A representative example of this cooperation is the current transdisciplinary research project "Lüneburg 2030+". The city has a sustainability representative who's job it is to bring all important actors together who need to be included in projects like this (Lüneburg 2030+ Website).

General profile

Location and Scope

The Lüneburg GLOCULL activities are a sub-lab of the larger Future of the City Lüneburg 2030+ real-world laboratory activities. The lab host various projects in the Hanseatic city of Lüneburg. In the future, lab activities will expand to the region.

Purpose

While the original 2030+ experiments are rather large scale experiments, the GLOCULL experiments will particularly focus on intervention related to the FWE nexus. They are planned to be developed and conducted by smaller teams.

Activities

The lab is particularly focused on experimenting with sustainability solutions in the broader context of the FWE nexus.

Timeframe

The interventions funded by GLOCULL will start in late 2019. The first intervention is planned to be finished by March 2020. After that the lab will focus on a second intervention beginning in April 2020.

Organizational Structure

The GLOCULL Lüneburg Case Study is part of the lab activities in Lüneburg's 2030+ lab. As described in the 'purpose' section, the GLOCULL experiments are a number of experiments conducted in this large lab that particularly focus on challenges in the FWE nexus. Currently there is a sub team of two master's students working on an intervention focusing on the use of green energy in local businesses. More interventions are planned for 2020.

Participants

The GLOCULL lab involves both academic (2 professors, 1 PhD student/research associate, 1 PostDoc/and non-academic actors, 2 master's students)

Background and History

Answers regarding the experiment are currently based on my perception that I gained through extensive talks with our student team leading the co-development of the intervention

Inputs

Awareness

As reported by our master students, the actors involved in co-designing the intervention are highly aware of the urgent need for a transition to clean energy in the German energy system (Energiewende).

Commitment

The actors involved in the experiment are very committed in co-designing and carrying out an intervention. The actors are motivated to support other local business owners to transition from conventional energy supply to clean energy and thereby become active drivers in a sustainability transformation of the local business sector.

Capacities (Expertise)

The different actors co-designing the experiment provide knowledge about the local business sector of Lüneburg, clean energy in Lüneburg and the German energy system, professional communication skills for the local business sector of Lüneburg.

Trust

Cannot be answered yet

Support

Cannot be answered yet

Process

In the Lüneburg case, the GLOCULL activities are taking place in a larger lab environment. Hence, the description of the lab processes would be very broad and not focusing the activities "surrounding" the experiments. We are currently integrating the work of two of our masters students into the lab. In the near future we will apply the framework to this case study and then be able to describe the processes of this sub lab.

Experimental procedure

X

Transformational Rationale / Methodology

X

Transdisciplinarity

X

Reflexivity and learning

X

Openness and transparency

X

Outputs

Capacities

X

Knowledge

X

Accountability and Commitment

X

Physical structures

X

Social structures

X

Uptake (transfer and scaling)

X

Outcomes

Socio-ecological integrity

X

Livelihood sufficiency and opportunity

X

Intra- and intergenerational equity

X

Resource maintenance and efficiency

X

Socio-ecological stewardship and democratic governance

X

Precaution and adaptation

X

More information

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Dutch Living Lab – SUPERLOCAL Kerkrade

Introduction

The SUPERLOCAL Living Lab is about a social housing real estate development project in the shrinking region of Kerkrade, Parkstad Limburg, the Netherlands. The aim is to transform the old housing stock (4 high rise buildings) into a circular neighborhood. Therefore around three subprojects have been formed: (1) Circular building; (2) Closed water cycle; and (3) Social circularity activities. The main aim of GLOCULL is to focus on the experiment the closed water cycle since this experiment results in the FEW nexus. This experiment is a collaboration between the drinking water company, waste water company, housing corporation and the municipality. The project is about closing the water cycle (climate adaptation, for both extremes: dry and wet), getting closer to residents and generating resources out of the water all on a local scale. In this way linking it to energy and resources (e.g. agriculture). In the new area, there will be 113 apartments, a social level, 13 ground level houses and 3 experimental houses. All residents left the neighborhood in 2012 due to increased risks with the flats (concrete rot).

Setting

Environmental

The SUPERLOCAl area is part of the municipality of Kerkrade and the neighborhood of Bleijerheide. It is located in a relatively hilly area of the Netherlands, on loess soils. The annual average rainfall is 843

mm with monthly averages varying from 56 mm to 83 mm. In summertime, the showers can be short and intense, but it may also rain for longer periods. The last two summers (i.e. 2019 and 2018) were very dry, causing drought problems for farmers. The area of Kerkrade used to be a mining area, until the closure of the last coalmine in 1974. South Limburg has a population density of 945 inhabitant per square kilometer, and cities/ villages are mainly surrounded by industrial areas and agriculture. The land use for agriculture is diverse, but mainly consisting of pastures (for cows, sheep and horses) and crops such as maize, potatoes, sugar beet, linseed and unions.

Social/ Cultural

Bleijerheide is currently facing demographic shrinkage. In Kerkrade (the municipality Bleijerheide is part of) the number of inhabitants decreased from 51,458 in 2000 to 45,642 In 2019. Most houses are built in the period from 1950-1970 when the region was thriving because of the coalmines. Annual incomes are relatively low in Bleijerheide (€ 19,900) and among the lowest for the entire Province of Limburg. Unemployment rates are relatively high as well (see: https://allecijfers.nl/gemeente/kerkrade/). Young people tend to migrate and around 30% of the population has a (non-Dutch) migration background. The area is traditionally Catholic, but only few people practice their religion actively. Social life fulfills quite a strong role in Kerkrade, for example via membership of Carnival organizations or concord. The idea of the experiment is that people who had to leave the area for the rebuilding activities, will get the opportunity to move back to the area after the activities have finalized.

Financial/economic

Annual incomes are relatively low in Bleijerheide (€ 19,900) and among the lowest for the entire Province of Limburg. Unemployment rates are relatively high as well (see: https://allecijfers.nl/gemeente/kerkrade/). The high-rise buildings that used to be located in the SUPERLOCAl area belonged to a housing corporation Heemwonen and were 100% social housing. The new building will still be property of the housing corporation and the majority (but not all) residences will be rented to people with low incomes (i.e. social housing). Official legislation requires the rent of social housing to be below € 720,42 monthly. The SUPERLOCAl project is a very costly project that relies heavily on external funds from IBA Parkstad, LIFE Climate Action programme (European Union), the Province of Limburg, Urban Innovative Actions. The experiment on the closed water system is particularly funded by the LIFE Climate Action programme (European Union), Heemwonen (housing corporation), the Municipality of Kerkrade, WML (drinking water company Limburg), and Waterschapsbedrijf Limburg (water board). Around 4,5 million funding is available for the experiment (closed water cycle). This is for around 50% from EU Life funding and the rest is coming from the four partners. Around 5 million funding is available for the Super Circular Estate experiment (around 70% EU UIA funding and the rest from 12 partners). The total area development will be far more than 25 million euro's. Coming from the housing corporation, municipality and the Province of Limburg.

Technical/ infrastructure

As there were buildings in the area before, there are connections to the centralized sewage, drinking and water management systems. The experiment with the closed water system partially uses already existing technologies (such as vacuum toilets, food grinders and helophyte filters).

Legal/ Political

Dutch law demands a constant verification of the quality of drinking water. It is technically feasible to filter waste water and purify it into drinking water, but as this formally demands constant monitoring of the quality by drinking water companies, this is currently not possible and too costly. Most Dutch households have one water inlet in their house. This implies that they use high quality drinking water for all purposes, including flushing the toilet, cleaning, and laundry. The use of rain barrels is stimulated (some municipalities provide subsidies), but hardly used by residents of high-rise building (mostly the subsidies only apply to rain barrels collecting rainwater that would otherwise flow into the sewage system).

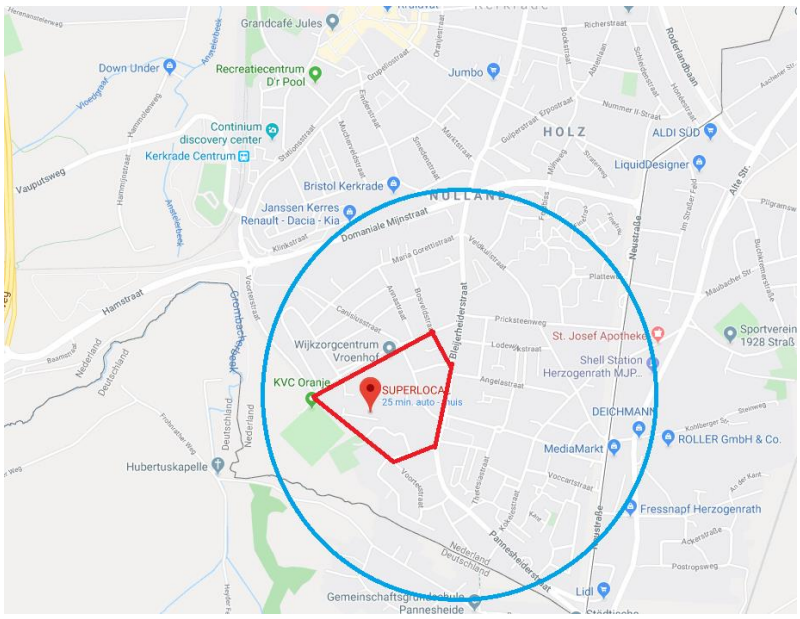
Organization/ capacity

One of the housing companies' employees took the role of a project leader/ central contact person. He turns out to be important in binding people together and to the project. The drinking water company is also highly motivated to make this project a success.

General profile

Location and Scope

The experiment takes place at the SUPERLOCAL location (area delineated in red in the figure below). This location is part of the neighborhood Bleijerheide (blue circle in the Figure below) in the city of Kerkrade. The area is demarcated by 4 streets: the Voorterstraat, the Sint-Antoniusstraat, the Ursulastraat and the Vroenstraat. Within this area, a circular (re)use of building materials is planned as well as the construction of close water cycle.



Purpose

The purpose of the closed water cycle is to experiment with the extent to which the system can be fully closed on a local scale and to learn about the contribution of the closed water system to climate change adaptation (both to better deal with droughts and to anticipate on rainfall peaks). Next, the purpose is to experiment with the generation of resources from wastewater to link wastewater to energy (biogas) and resources (agricultural resources).

Activities

The experiment with the closed water system is embedded in the project on circular building project. Under the umbrella of the larger circular building project, there will be 3 circular experimental dwellings. These dwellings are built from retrieved material from the demolished high-rise buildings. In one of these test dwellings, vacuum toilets will be installed so that interested people or potential new inhabitants can experience the vacuum toilets already. At the end, all dwellings will have real inhabitants and working water saving technologies. These dwellings will be used to learn and build all the other dwellings based on the results of these experiment dwellings. The coordinator of the sub-project on the closed water system is also involved in the other projects. Within the closed water system experiments, regular meetings take place, including expert meetings.
In the indexation phase all valuable parts of the project site where described (social, water, energy, materials, history etc.). Based on these outcomes the play phase was initiated in which for the building an expo pavilion was build (in order to learn). Currently, three circular experiment dwellings are build. These will have real inhabitants and working water saving technologies. Again these will be used to learn and build all the other dwellings based on the results of these experiment dwellings. 3-weekly integral project meetings are organized. Furthermore, a PhD researcher is responsible for connecting all the outcomes of the subsystems to an integral outcome. Nevertheless, all partners see this project separate from their regular activities. Also, a neighborhood advisory board is active in which every street in the area has a ‘major’ (i.e. representative) that takes part of the group. Furthermore, currently information panels are installed in which the newsletters (which are also delivered to the houses) are placed. Lastly, every month there is an open exposition. Every person willing to visit is welcome to visit the expo pavilion and ask questions. In the future plenty of other activities with the residents will be planned. More activities:

- Two day pressure cooker event (2016)
- Workshop sessions (climate adaptation) with engineers from Tauw (2017)
- Kick-Off and second meeting Expert Group (2019)

Timeframe

Early 2020: first residents in 3 experiment houses
Summer 2020: CAWM-system operating and testing
Winter 2020: All residents move in.
Winter 2021: All CAWM-systems connected to residents
Summer 2023: Afterlife plan comes into force
From now until 2023: Research

The external funding's will end in 2020 (UIA) and 2023 (LIFE). The fact that the UIA funding will end in 2020 and delays occurred, some parts of the experiment are becoming rather difficult. This issue might result in changes of the concept (experiment) and in changes of deliverables (for the subsidy). The project is planned to sustain for at least 30 years. After which it can be updated for some more years to follow.

Organizational Structure

The project manager of the housing corporation is working on this project since day one, and can be seen as the leader. He is highly committed and can be seen as the glue between all experiments and partners. If he would leave the project, a lot of issues might arise. Working on one single location for such a long period brought actors closer to each other. This also results in looking for new projects on other locations. Spending time with each other results in speaking the same language and understanding different perspectives and stakes. The housing corporation and the municipality are the lead partners in the project (ULL). They are responsible for the entire project. WML is the lead partner of the closed water cycle experiment (and LIFE subsidy), meaning the process. Every partners has its own ownership over their assets. The formal responsibility is spread over the partners. The project managers have to update a steering group (consisting out of the members of the boards of all the partners). The learning outputs are managed by WML but this is not made formal. The risk that WML will not do this (or to less) will just result in less knowledge production. Making the project less impactful but not a failure for the partners. Due to the circular character of the project there are a lot of dependencies. Resulting in potential risks if one partner drops out or does not comply. Most of these risks are written down in the cooperation agreement.

Participants

ULL core team:

- Housing corporation (initiator and project management ULL);
- Municipality (urban planner and area developer, and project manager UIA subsidy);
- Regional exposition organization (communication)

Experiment actors closed water cycle:

- Housing corporation (developing technologies in houses and responsible for residents and social activities);
- Municipality (responsible for developing water park area, flood management and sewage systems);
- Drinking water company (overall experiment manager and responsible for drinking water systems and research and dissemination);
- Waste water company (responsible for wastewater management and resources)
- Residents (will become involved once they are known, currently nobody is living in the area)
- Neighbors (street 'majors' in a neighborhood advising platform)
- Researchers (from different universities and research institutes)
- Policy advisors (on a periodic basis)

Background and History

As described above, the experiment is part of the larger real estate development – named SUPERLOCAL – in which more partners work together. This all is done in a region which is currently in the process of an International Building Exposition (IBA). They (IBA) focus on different transitions and support the project from the region. In the past, the first Transition Management process (around 2001) in history was set up in this region (see Grin, Rotmans & Schot, 2010). This potentially coincided the terms transitions, experimenting for sustainability transitions etc. in this region. Ensuring that the decision makers where more open and willing to contribute to such a large-scale transition experiment. Besides, two water partners that are part of the Closed water cycle experiment that joined the project later (around 2016) started in 2014 with a small scale experiment in the Wijk van Morgen in which they experimented with different household technologies. Nevertheless, this was a bit too early and the scale was too small and therefore 'failed', more or less. Bringing both developments together, both focusing on sustainability transitions created room for experiments.

Inputs

Awareness

The involved organizations do see a need for change and use this experiment to learn how to change. Nonetheless, residents see a different need for change. They see that the quality of the neighborhood and the dwellings need to be improved. They possibly see less need for a change towards sustainability and a closed water cycle (i.e. climate change adaptation).

Commitment

The aim of the experiment is not to sell the concept or technologies but to develop a climate adaptive sustainable water system. This increases commitment of the partners. This is also true as most technologies that will be used are already tested in other experiments (e.g. in other countries). The reason for commitment may differ across partners, but most partners seem to be committed to learning from this experiment.

Capacities (Expertise)

Power is not equally distributed between the partners because of larger or smaller roles in the project and because some partners are in the lead for overall project and research management. This inequality is managed during 3-weekly meetings and with a lot of bilateral coordination (phone, mail etc.) between partners. Some partners have at certain moments not enough funding or workforce available and do experience unequal distributed power/capacities. This is openly discussed but not easily solved. The end-users (residents) have less power since there only choice is to agree with the system or not. This is managed by providing information and showing them that this will save money. Expertise on the technologies mainly lies within WML, although they closely cooperate with others. Part of this cooperation also focusses on expertise on how people will use the innovations, as the inhabitant's behavior will strongly influence the effects of the experiment.

Trust

The core working group has been working with each other for the last 3,5 years. Within this group there is transparency trust and openness. Since project managers entered the arena, and they are dealing with their own part of the experiment, this atmosphere has changed a bit. There is less trust (also due to the lack of effort of some partners) and more politics come into play. The core working group is still active and due to their combined experience and history are able to hold track of the aims of the project. Concluding, since there are obligations made the openness of individuals has changed. Residents will be selected based on their history (did they live here before) and their willingness to live in a sustainable project. This does not mean that they will trust each other. It will all be new residents and creating social cohesion, in an individualistic society, is one of the challenges and aims of the project. This will strengthen trust among residents.

Support

Information on the experiment's funding is provided under the construct "financial/ economic" setting. Participants in the expert meetings receive a travel allowance and –in some cases- a participation fee.

Process

Experimental procedure

The experiment is a process in which the results so far are emerging outcomes. By hosting sessions with residents an external experts the experiment is constantly reshaped and co-designed. Before climate adaptation was for example not part of the closed water cycle. Based on studies and weather conditions this became the main aim of the project. The starting point was integral water management on a local scale focused on transitions. Ideas of how this system would look like where developed along the way, influenced by experts, engineering organizations, architects, residents etc. The subsidies provide room for failure. But in practice, it differs per partner whether there is room for failure. For the technologies that will remain indefinitely in the households the room for failure is limited. The technologies that will be tested for 3 years provide more room for failure. But some partners want to see success, while others are primarily interested in the research outcomes and the implication for strategic questions. In the last case, both a success and failure are valuable. The level of politics within organizations influences the room for failure.

Transformational Rationale / Methodology

Different theories of change apply to this experiment:

- Technological/Environmental: Different sustainability technologies are tested and connected to understand their individual and combined impact on the environment.
- Social: How residents perceive, accept and act in relation to these innovations is one of the main aims of this project
- Institutional: Organizations are trying to understand the impact of the energy, water and circular transitions. Based on this they try to find their new roles within these new economies.

By doing this experiment the different organizations are able to distil potential new roles for themselves (such as providing other services).

Furthermore, one way of institutional change is the integrated water management on a local scale. Although many countries do this, in the Netherlands the water sector is highly institutionalized, in silo's and in managed in centralized fashion.

Transdisciplinarity

Scientific and practical (experts from other projects and market parties) knowledge is used in order to develop a state of the art system. *Knowledge that is produced:* A variety of knowledge will be produced: A posteriori, Domain knowledge, Empirical knowledge, Encoded knowledge, Procedural Knowledge, Tested knowledge, and Situated knowledge. So both scientific and practical knowledge which are needed for understanding and managing transitions. The experiment is nested at a geographical location which can be used for networking and knowledge co-creation. Knowledge of several groups is currently used to help the project. And in the future the knowledge that will be generated is planned to flow back to these groups. These groups include (1) residents; (2) neighbors; (3) experts (social researchers, communication, water quality, microbiologists, practitioners, business developers, architects, urban planners etc.).

The Public sector is the main driver in the project. In order to learn and influence rules and legislation the scientific community is also part of the project. A wider group of public and policy professionals are connected to the project (expert group or throughout bilateral meetings). And lastly, the private sector will soon be involved as well. This will happen after the tender procedure.

Actors from different academic domains are involved: sustainability sciences (transitions, trans- and interdisciplinary); Hydrology; Process technology (water); Social sciences; Architecture and building; and perhaps psychology. The basic (research) questions have been formulated by the project partners in the core working group. These are written down in the cooperation agreement. Based on these and with feedback of the (inter)national expert group a research plan is developed by the research manager and KWR Watercycle Research Institute. For this plan all partners have been interviewed. Out of all this information some major research fields and indicators (KPI's) have been developed. The next step is formulating detailed research questions.

The core of the overall research approach is Mode 2.0 science with the aim to generated actionable knowledge. If articles are published it is with the aim to influence policies. Furthermore, the end product of the study is not a document but will come in different forms. The methods used so far in the experiment are: visioning, integral business cases (excel), design thinking, flow diagrams, and modelling. The methodological approach underlying this experiment is action research.

Reflexivity and learning

The approach towards learning is central to the experiment. Nonetheless, the kind of learning (practical, strategic, scientific) differs per partner. A research manager was appointed in order to structure the learning process. Furthermore, a research and evaluation plan is developed in advance of the project in order to ensure that the right data and questions are gathered. Without the research manager most project managers would forget to include the learning aspect. Especially since most of

the learning will occur when residents move in, and for project managers the installations will already be built.

Learning is stimulated by the research manager in coordination with the core working group. In the concept development phase reflexivity was part of the design. This was due to the type of professionals involved. During the planning phase this becomes more difficult and is being monitored by the core working group and the research manager. The learning outputs are managed by WML but this is not made formal. The risk that WML will not do this (or to less) will just result in less knowledge production. Making the project less impactful but not a failure for the partners. Part of the actors' commitment to the project/ experiment is created via learning (and a willingness to learn from this experiment).

Openness and transparency

One of the core values of the overall project is total transparency. Hence, all data and outcomes will be made publicly available (mainly online). This is in line with the European subsidies. So far, this has not created tensions yet. Power is not equally distributed between the partners because of larger or smaller roles in the project and because some partners are in the lead for overall project and research management. This inequality is managed during 3-weekly meetings and with a lot of bilateral coordination (phone, mail etc.) between partners. Some partners have at certain moments not enough funding or workforce available and do experience unequal distributed power/capacities. This is openly discussed but not easily solved.

Outputs

Capacities

Capacity is built during several moments with help of external expertise and moderators. The internalization of skills and the way in which the innovations will be used by the residents however, will be interesting and crucial to the success of the project. There will be information provided to residents on the food they can grind, on what they can flush through their vacuum toilet and on the way in which they should treat the filtering area. The extent to which the inhabitants can be optimally empowered to use the innovations in a sustainable way will be part of the experiment.

Knowledge

The experiment aims to increase our scientific understanding of: Transition experiments, Transition management, Water management, Modeling for urban water systems, Learning for transition experiments. Insights will be collected in a PhD dissertation that will be constructed based on action research.

Accountability and Commitment

The core of the overall research approach is Mode 2.0 science with the aim to generated actionable knowledge. If articles are published it is with the aim to influence policies. Furthermore, the end product of the studies is not a document but will come in different forms. The extent to which residents can use the innovations with confidence is not clear yet, but will be part of the experiment.

Physical structures

The used technologies are not necessarily very new as they have been applies in different sectors (e.g. vacuum toilets in navigation or airplanes) or different countries (food grinders in the USA). In the Netherlands it is however new to integrate these technologies in one geographical area and to guarantee water supply and treatment locally.

Social structures

Social structures will not be radically changed. We aim to develop innovations that contribute to climate change adaptation without impacting human possibilities negatively. Behavior and practices may change a bit (e.g. making use of a common laundry machine, grinding some food left-overs, not using the playing field after a rainfall peak, not allowing your dog to use the filtering area as a toilet).

Uptake (transfer and scaling)

The experiment identified a second location (i.e. a rather isolated farm in Belgium) where the same experiment will be performed. Upscaling and transitioning is an explicit topic within the project. How and to what extent the project may be upscaleable, is still to be seen.

Outcomes

At the time of writing this description, there have been no appreciable outcomes. What is described here, therefore, are generic descriptions of the type of outcomes that SUPERLOCAL anticipates. These then become, to some extent, the basis for design guidelines for the experiments and lab.

Socio-ecological integrity

The innovation may lead to a more efficient use of water which may benefit the surrounding environment in times of droughts and peak rainfall periods. Waste water is treated locally and reused for different purposes. Also energy will be more efficiently used as heat from shower waste water may be reused and the waste from the vacuum toilets and food grinders will be used to create biogas and resources for agriculture. It is not sufficiently clear what the demand for agricultural resources will be, both locally and beyond a local scale. In the Netherlands, there is an excess of nitrogen. As a consequence, there are strict regulations on the use of fertilizers and agricultural resources. Finally, by using vacuum toilets, the water use per toilet visit will be much lower compared to a normal toilet (i.e. 1.0-1.5 liters of water compared to 6-8 liters).

Livelihood sufficiency and opportunity

In the Living Lab area, basic humans needs are generally already met. Economic opportunities and therewith additional livelihood support may be created because inhabitants have lower costs due to water and energy saving and having to offer less organic waste to the waste facilities (in the Netherlands it is common, but not unified, that people pay per kilogram of waste and/or each time they use the garbage collection service). However, as especially water is very cheap in the Netherlands, we cannot expect the experiment to have a large influence here.

Intra- and intergenerational equity

The innovations are offered in a social housing estate. This guarantees that the innovations are fully affordable to low-income households. The innovations are also planned to stay for at least 30 years. This means future generations may be able to benefit from the lessons learnt and technologies used in the experiment, but the actual innovations within the SUPERLOCAL area will probably not last much longer than 50 years. As the experiment furthermore designs a locally closed water cycle, other regions will not be negatively affected (i.e. no water will be extracted from other regions, less energy will be extracted from elsewhere). The experiment does not change the food supply to the inhabitants; only food waste is managed via the experiment.

Resource maintenance and efficiency

The use of non-renewable energy is limited because of the experiment (i.e. food and –toilet waste are re-used to create biogas, and heat from shower wastewater is re-used). The use of energy per unit use will therefore be lowered. Also the water used for toilet visits will be reduced by a factor 6-8. Besides, treating water locally may be less efficient from an economic point of view (i.e. infrastructures for central water treatment are already in place), but once the local treatment functions optimally, it may also contribute to costs-savings (e.g. maintenance of pipes and large treatment plants).

Socio-ecological stewardship and democratic governance

Future stakeholders (both short term and intergenerational) are not explicitly involved/ considered in the first stages of the experiment. The main reason is that no people are living in the SUPERLOCAL area at the moment. It is also not known who will be living there after completion of the residential areas/ dwellings. In the design of the experiment, the involved actors try to consider potential concerns and desires from inhabitants. For example, they paid attention to reducing the noise from flushing vacuum toilets and they weighted the advantages and disadvantages of food grinders per apartment and per floor (in the high-rise building). The innovations will formally be owned by the housing corporation who rents the apartments, but as the residents will use the innovations within the private sphere of their homes, we expect them to have a sense of ownership over the innovations once they live there.

Precaution and adaptation

One of the underlying aims of the experiment is to better anticipate on the effects of climate change. For Kerkrade, these threats include more droughts in the summer period, and more intense rain peaks (all year). Rain peaks may cause a lot of problems such as floods, erosion and overburdening the sewage systems (in extreme cases the sewage system may drain back in people's houses (e.g. toilet, kitchen sink). Further, the main uncertainties the experiment is dealing with relate to human behavior and use of the innovations. Will future inhabitants use the innovations in the right way? If they don't (e.g. by throwing away drug-waste in the vacuum toilets, by grinding garden waste in the grinders, by allowing their dogs to use the filter area as toilet) this may seriously effect the impacts of the innovation. In the experimental dwellings there is still room for failure, but once people live in the apartments, failure of the entire system would not be an option. Potentially, water can be supplied

centrally again in the future, but it will take time to prepare all connections. For the sewage connections, this may be even more complicated.

More information

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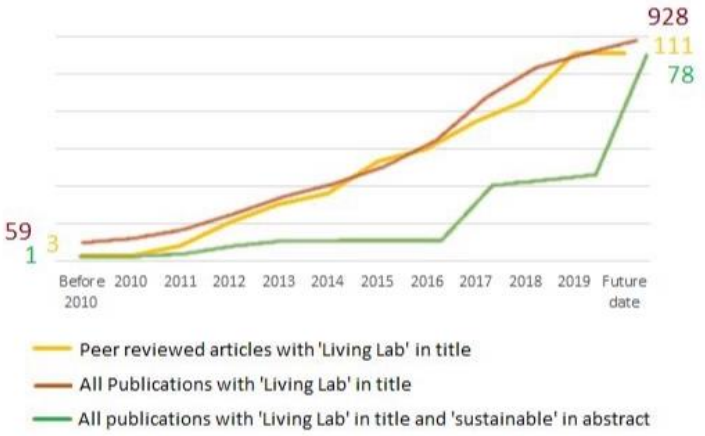
Annex 1 – Numbers of publications on Living Labs



Based on a literature search on the UM (Maastricht University) library catalogue on July 2019. Numbers refer to the numbers of publications.